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A TAXONOMIC REVISION OF SOUTHERN AFRICAN CASSINOIDEAE (CELASTRACEAE)

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A TAXONOMIC REVISION

OF

SOUTHERN AFRICAN CASSINOIDEAE (CELASTRACEAE)

by

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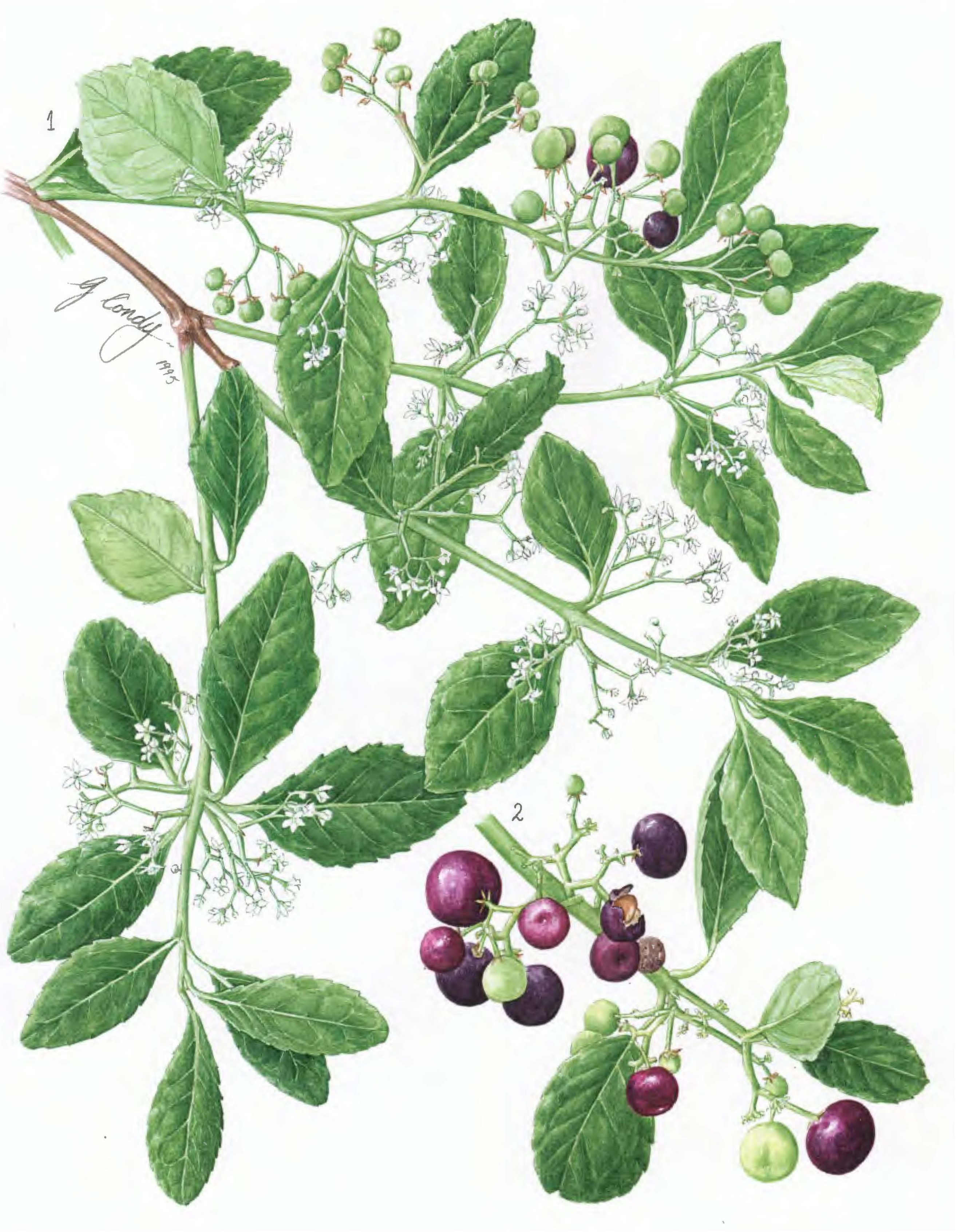

Plate 1. *Cassine peragua.* **Figure 1**. Portion of flowering and fruiting branches. **Figure 2**. Fruiting branch. Voucher specimens: 1 From *Hahn & Archer 195*, 2 from *C. & R.H. Archer 2045*. Artist: Gillian Condy.

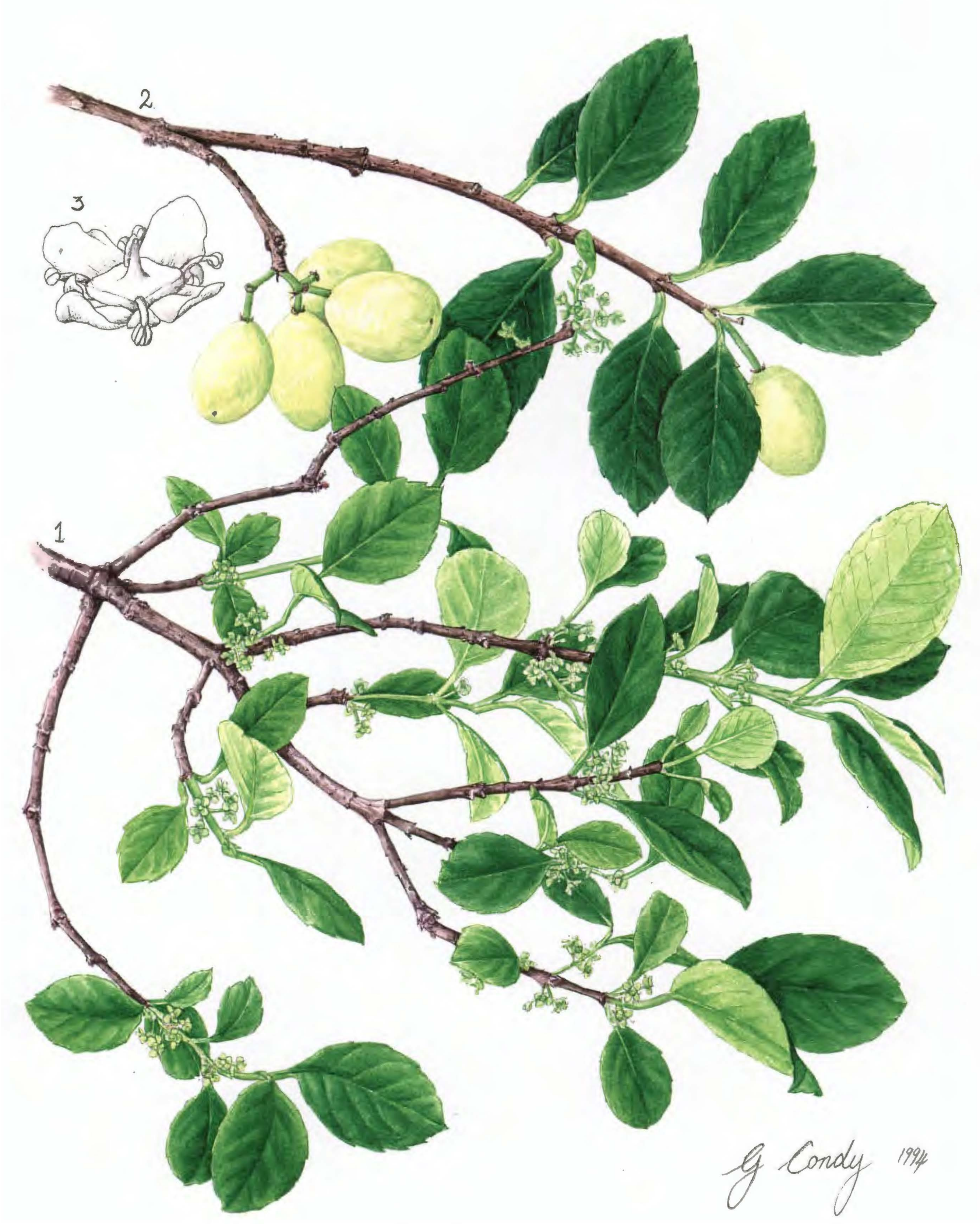

Plate 2. *Elaeodendron croceum*. **Figure 1**. Portion of flowering branch. **Figure 2**. Fruiting branch. **Figure 3**. Detail of flower. Voucher specimen: *Archer 2090*. Artist: Gillian Condy.

Plate 3. *Mystroxylon aethiopicum* subsp. *schlechteri.* Portion of flowering and fruiting branch. Voucher specimen: *Archer 2112*. Artist: Gillian Condy.

Pulchra quae videntur,
pulchriora quae sciuntur,
longe pulcherrima quae ignorantur.

[What we see is beautiful,
What we know is more beautiful,
What we don’t even know is the most beautiful of all.]

Niels Stensen (1673)

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CHAPTER 1

INTRODUCTION

The family Celastraceae occupies an important position in the woody southern African flora in respect of numbers and economically useful members (e.g. for potential wood production, medicinal and ethnobotanical uses). Celastraceae is the largest family in the order Celastrales, comprising more than 50 genera and 500 species (Cronquist 1981). Recent multidisciplinary studies have indicated that several families, such as the Dichapetalaceae, Icacinaceae and Aquifoliaceae, should be excluded from the Celastrales (Cronquist 1981; Dahlgren 1980; Thorne 1983; Spighiger *et al.* 1993). This makes the order Celastrales smaller, more homogeneous and easier to define. The Celastraceae is rather diverse, especially with reference to fruit morphology. Some groups have at times been treated as separate families, e.g. Canotiaceae, Goupiaceae, Hippocrateaceae, Lophopyxidaceae and Siphonodontaceae. Several subfamilies were proposed by Loesener (1892, 1942a), Croizat (1947), Airy Shaw *et al.* (1973), Villiers (1975) and Hallé (1962, 1988). The subfamilial classification though, is not in general use in the literature. Provisionally, at least four subfamilies can be recognized in southern Africa, namely Celastroideae, Cassinoideae, Hippocrateoideae *s. str.* and Salacioideae.

Traditionally all celastraceous members with drupe-like fruit were referred to the tribe Eucassineae, which in turn was placed in the Cassinoideae, a subfamily Loesener (1892, 1942a) based on the indehiscence of the fruit. Loesener (1942a) recognized seven genera among the southern African Cassinoideae, namely *Cassine* L., *Elaeodendron* Jacq., *Hartogia* L.f., *Lauridia* Eckl. & Zeyh., *Maurocenia* Mill., *Mystroxylon* Eckl. & Zeyh. and *Pleurostylia* Wight & Arn. In addition, *Pseudocassine* Bredell was treated separately in the Hippocrateaceae (Loesener 1942b). Robson (1965, 1966) added a new genus, *Allocassine* N. Robson and resurrected *Crocoxylon* Eckl. & Zeyh. Codd (1983) provided a new name, *Hartogiella* Codd, to replace the illegitimate *Hartogia* L.f. *non* L.

In recent years the National Herbarium (PRE) in Pretoria has applied the name *Cassine* in a broad sense, comprising all the southern African members of the Cassinoideae except *Allocassine* (in a restricted sense), *Hartogiella, Maurocenia*, and *Pleurostylia* (Arnold & De Wet 1993). The first three of these latter genera are treated as monotypic and *Pleurostylia* as consisting of one species in the Flora of Southern Africa [FSA] area. This inclusive concept for *Cassine* follows the taxonomic opinion of authors such as Loesener (1892), Davison (1927), Ding Hou (1962), Codd (1966) and Kostermans (1986) and has also been uncritically adopted in popular-scientific tree books (e.g. Palmer & Pitman 1973, Coates Palgrave 1977, Von Breitenbach 1987). *Cassine s.l.* is a cosmopolitan genus distributed in Africa, southeast Asia, Australia and with a few species in south and central America. Although it has become customary to use *Cassine* in a broad sense, some recent authors have preferred to retain at least some segregate genera, e.g. Robertson (1989), Zhang Zinying *et al.* (1990), Robson *et al.* (1994) and Green (1994).

The principal objective of the present study was to provide an assessment of generic limits and a taxonomic account of the southern African Cassinoideae. A practical hypothesis (in the form of a new classification) is presented and an appropriate system of natural classification is proposed. It is hoped that the results of this work will initiate and assist phylogenetic studies in the entire subfamily and ultimately contribute to an enquiry into the evolution of the Celastraceae and the order Celastrales. No attempt at cladistic analysis has been made due to the fact that not all members of extra-African Cassinoideae were included in the study.

It is fortunate that most of the genera of this study are endemic or near endemic to the southern Africa region or Africa. Revisions of five genera provided here are thus monographic. With the exception of the extra-African members of *Elaeodendron, Mystroxylon* and *Pleurostylia*, an account is given for each species over its range outside the southern African region, as far as possible. It is now realized that *Pleurostylia africana,* a tropical African species, does not differ significantly from *P. capensis* in southern Africa and should be sunk. *Elaeodendron* is the only large cosmopolitan genus in the Cassinoideae, comprising ± 30 species. The proposed generic concept of *Elaeodendron* necessitates many reversals back to the original basionyms in *Elaeodendron* for most species of *Cassine s.l.* from other parts of the world. Fortunately most species have been well-known under *Elaeodendron* at some stage or another. Eight members of this genus are confined to Africa (excluding the Mascarenes and

Madagascar), and are to be revised presently. A synopsis of the known species of *Elaeodendron* worldwide is being attempted, but is not included in this dissertation.

An assessment of the taxonomic significance of characters from various sources, as well as a preliminary hypothesis on generic delimitation were presented in my M.Sc. thesis (Archer 1990). Some papers on the wood and bark anatomy as well as palynology of the southern African Cassinoideae, forthcoming from the thesis, are added as Appendices (6–8) to the present dissertation for the convenience of readers. Frequent reference is made to these results. Note, however, that since the completion of the M.Sc. thesis, results from much additional research and information on the various subjects have been obtained and are included in these published papers.

Various published papers and unpublished manuscripts, on taxonomic and nomenclatural aspects of the southern African Cassinoideae are also presented here, as Appendices 1–5 and in the Taxonomic treatment. These publications include a key to the genera of subfamily Cassinoideae (Archer & Van Wyk in press, a), the accounts of two species for the *Flowering Plants of Africa* (Archer 1995, in press), a proposal for the conservation of the name *Cassine barbara* L. with a new type (Archer & Van Wyk 1995), and notes on the correct orthography and author citation of *Elaeodendron* Jacq. (Archer & Van Wyk in press, b). In the Taxonomic treatment (Chapter 5) each genus is presented in the form of a manuscript prepared for submission to a scientific journal. To avoid unnecessary duplication, details on materials and methods were consolidated in Chapter 3. Literature references are arranged together (Chapter 10). Papers in the Appendices and the Taxonomic treatment will show some stylistic irregularities due to differences in layout required by the various journals.

CHAPTER 2

HISTORICAL REVIEW OF THE CASSINOIDEAE

Cassine peragua L. and *Maurocenia frangula* Mill. were not uncommon in cultivation in Europe in the 18th century. Both species were described and illustrated by Plukenet (1691), Petiver (1702–9), Boerhaave (1710), Dillenius (1732) and Linnaeus (1737) before 1753. Linnaeus recognized *Cassine* and *Maurocenia* as separate genera in the first edition of *Genera Plantarum* (1737). However in 1753, he sank *Maurocenia* under *Cassine* and recognized two species, *Cassine peragua* and *Cassine maurocenia.* The genus *Maurocenia* was subsequently validly published when the genus was reinstated by Miller (1754), in an attempt to rectify what he thought was an error on Linnaeus's part. Although *Cassine maurocenia* forms the basis of Miller's resurrected *Maurocenia*, Hitchcock & Green (1929) chose this species as the lectotype of *Cassine.* Jarvis (1992) proposed the conservation of *Cassine peragua* as the lectotype of the genus, thereby avoiding the possible need for a new name for *Cassine.* Linnaeus (1771) changed his concept and applied *Cassine peragua* to a specimen from Carolina (Bahamas according to Stearn 1957) and gave a new but illegitimate name, *Cassine capensis* to the African species.

Ecklon & Zeyher (1834/5) collected extensively in southern Africa. Their fieldwork enabled them to describe several new genera and species of southern African Celastraceae. However, many of their new names appear to be based on local variants and few of these are upheld today. *Mystroxylon* Eckl. & Zeyh. and *Lauridia* Eckl. & Zeyh. are resurrected in the present treatment. Ecklon & Zeyher specimens were widely distributed in Europe and authors like Meyer (1836/8) and Turczaninow (1858) provided several names for southern African Celastraceae, based on these collections.

Sonder's (1860) treatment of the 'Celastrinae' in *Flora Capensis* retained most of Ecklon & Zeyher's genera. A number of new species were described. This revision is the first and only treatment of the southern African Celastraceae until that of Davison (1927).

The most recent comprehensive treatment of the southern African Celastraceae was provided by Davison (1927). She could not find sufficient differences between some of the genera and lumped several of them, namely *Elaeodendron, Mystroxylon* and *Scytophyllum* (but not *Lauridia*) into *Cassine. Lauridia* was kept separate on account of its 'unique racemose' inflorescences.

Between 1892 and 1942, Loesener published several contributions on Celastraceae, the last and most significant being a monographic treatment of the family (with Hippocrateaceae treated separately) in *Die natürlichen Pflanzenfamilien,* published after his death in 1941. He probably made the most significant contribution to the taxonomy of the Celastraceae worldwide. Perhaps one of his main contributions was to establish five subfamilies based mainly on fruit structure. Together with a possible two additional subfamilies, Hippocrateoideae and Salacioideae, up to eight subfamilies can be recognized. However, this suprageneric classification of the Celastraceae is ignored in most systematic works on Celastraceae with the result that the enormous diversity within the family is not generally appreciated.

In the Cassinoideae, Loesener (1894, 1942a) placed much emphasis on the presence of scalariform perforation plates in wood to distinguish *Elaeodendron* from *Cassine*. Loesener (1942a) treated *Elaeodendron* as a cosmopolitan genus comprising 30 species. However, considerable confusion about the interpretation of the type of perforation is notable from the literature. Owing to the inconsistent application of the generic names *Elaeodendron* and *Cassine* to southern African taxa, Metcalfe & Chalk (1950), Blakelock (1957) and Ding Hou (1962) concluded that scalariform perforation plates occur in both genera.

Loesener (1892, 1893) originally considered *Cassine* in a wide sense, but recognized two subgenera, *Elaeodendron* and *Mystroxylon,* as well as two sections, *Eucassine* and *Euelaeodendron* in the first mentioned subgenus. Loesener (1942a) recognized seven species of *Cassine* in southern Africa and Madagascar. The species from Madagascar, *Cassine micrantha* (Tul.) Loes. (=*Elaeodendron micranthum* Tul.), however, is quite different in many respects from both genera. Loesener (1942a), in contrast to some of his earlier publications, advocated smaller, more homogeneous genera, not only in the Cassinoideae, but also in the Celastroideae, e.g. where *Maytenus* and *Gymnosporia* were recognized.

In a revision of Celastraceae for the *Flora Zambesiaca* area, Robson (1965, 1966) mainly followed Loesener's (1942a) concept of the Cassinoideae, except that he resurrected *Crocoxylon* Eckl. & Zeyh. and described a new genus, *Allocassine* N. Robson. Robson was able to do fieldwork in southern Africa, and appreciated differences in habit. *Crocoxylon* was not accepted by Codd (1966) who also restricted *Allocassine* to only one of the two species in Robson's (1965) original concept. Although the Eucassineae is characterized by exclusively drupaceous fruit according to Loesener (1942a), Robson's *Allocassine tetragona,* with baccate fruit, was uncritically retained in *Cassine s.l.* by Codd (1966). Robson (1965) treated *Lauridia reticulata* as a species of *Elaeodendron* and considered it closely related to *E. schlechteriana.* This decision was presumably made on the basis of leaf shape in some forms of *E. schlechteriana.*

Codd's (1966) judgement of Robson's *Flora Zambesiaca* treatment could be considered too drastic and as not giving adequate recognition to Robson's meticulous studies. Codd did not encourage further research on the topic and asked 'whether any useful purpose is served by attempting to split up a heterogeneous but easily recognized group [*Cassine s.l.*] into a number of units'? (Codd 1966: 123). Since 1966 little has been contributed to the study of the southern African Cassinoideae and it has become customary to use *Cassine* in a broad sense (Ingram 1975; Lobreau-Callen 1975; Jessup 1984; Kostermans 1986). Kostermans (1988) even maintained that the splitting-up of existing taxonomic units 'serves as a nice plaything for some taxonomists'. However, the comments of Kostermans and Codd discourage taxonomists from aiming at a natural and informative classification, an achievement towards which all taxonomists should work.

Efforts to distinguish between the various segregate genera of *Cassine s.l.* have unfortunately not always been based on taxonomically sound morphological characters. Distinguishing characters used were often inconsistent and difficult to apply to all the members of a group. This lack of good morphological or any other evidence for differentiating between genera has further contributed to the conflicting opinions regarding the generic limits of the southern African Cassinoideae. There can be no doubt that the limits of *Cassine s.l.* are exceptionally broad, and, because of its heterogeneity, it is highly unlikely to be a natural assemblage. With the accumulation of new evidence from comparative morphology and anatomy as well as other sources (Archer 1990; Archer & Van Wyk 1992, 1993a, 1993b), a better understanding of the generic limits in the Cassinoideae is accomplished and forms the basis of the taxonomic treatment of the southern African Cassinoideae presented here. As a result of this study, 10 new combinations are proposed within eight genera recognized (Table 1.).

Table 1. List of revised genera of southern African Cassinoideae and new combinations resulting from this study.

1. *Cassine* L.
    - *C. peragua* L. subsp. *peragua*
    - *C. peragua* subsp. *barbara* (L.f.) R.H. Archer
    - *C. peragua* subsp. *affinis* (Sond.) R.H. Archer
    - *C. parvifolia* Sond.
    - *C. schinoides* (Spreng.) R.H. Archer
2. *Lauridia* Eckl. & Zeyh.
    - *L. reticulata* Eckl. & Zeyh.
    - *L. tetragona* (L.) R.H. Archer
3. *Allocassine* N. Robson
    - *A. laurifolia* (L.f.) N. Robson
4. *Maurocenia* Mill.
    - *M. frangula* Mill.
5. *Robsonodendron* R.H. Archer
    - *R. eucleiforme* (Eckl. & Zeyh.) R.H. Archer
    - *R. maritimum* (H. Bol.) R.H. Archer
6. *Mystroxylon* Eckl. & Zeyh.
    - *M. aethiopicum* (Thunb.) Loes. subsp. *aethiopicum*
    - *M. aethiopicum* subsp. *burkeanum* (Sond.) R.H. Archer
    - *M. aethiopicum* subsp. *macrocarpum* (Sond.) R.H. Archer
    - *M. aethiopicum* subsp. *schlechteri* (Loes.) R.H. Archer

7 *Elaeodendron* Jacq.
    - *E. croceum* (Thunb.) DC.
    - *E. transvaalense* (Burtt Davy) R.H. Archer
    - *E. zeyheri* Turcz.
    - *E. matabelicum* (Loes.) Loes.

8 *Pleurostylia* Wight & Arn.
    - *P. capensis* (Turcz.) Oliv.

CHAPTER 3

MATERIALS AND METHODS

Davison (1927), who provided the most recent comprehensive taxonomic revision of the southern African Celastraceae, as well as the herbarium practice adopted by PRE (Arnold & De Wet 1993), forms the basis of this study at species level. A traditional morphologic-taxonomic approach was employed for the present revision of the southern African Cassinoideae.

All southern African members of the Cassinoideae were studied in their natural habitat between 1988 and 1995. All herbarium specimens of the group in PRE and PRU were examined. Specimens were obtained on loan from various European, USA and other herbaria (B, BM, COI, K, LISC, MEL, MO, P, S, TCD, Z). Herbarium acronyms follow Holmgren *et al.* (1990). Material of extra-African Cassinoideae was also obtained on loan and studied for comparison. A study tour was made during July and August 1993, during which most of the relevant type material was consulted in BM, K, LINN, LINN-S, S, SBT, and UPS. Southern African herbaria, BOL, GRA, J, NBG, NH, KNP, SRGH, STE, and UNIN were also visited. WIND was in transit and its specimens were not available. The total number of herbarium specimens studied and recorded comprises about 4000 sheets. I attempted to annotate most herbarium sheets examined. The vast number of Ecklon & Zeyher exsiccatae poses its own unique problems since most original labels were replaced and various numbering or code systems were used. In the selection of holo- and lectotypes from these collections the recommendations of Nordenstam (1980a, 1980b) and the *International Code of Botanical Nomenclature* (Greuter et al. 1994) were adhered to as far as possible.

Specimens cited here are arranged by the quarter-degree reference system of Edwards & Leistner (1971), Leistner & Morris (1976). One specimen is cited per quarter degree. Localities north of the equator, or west of Greenwich are indicated by the letters N or W after the longitude or latitude respectively. The codes for the geographical divisions of the *Flora of Tropical East Africa* (Polhill 1988) have been added to those specimens cited. A full list of specimens examined are provided in Appendix 9.

The colour illustrations of three species were prepared by Miss Gillian Condy for the *Flowering Plants of Africa*. Permission has been given by the NBI to reproduce the illustrations here.

CHAPTER 4

DIAGNOSTIC CHARACTERS

The following is a short summary of useful diagnostic characters employed in the proposed new classification of the southern African Cassinoideae (Chapter 5). Most of these are fully reported in my M.Sc. thesis (Archer 1990) and in additional published papers on the palynology, macromorphology and general anatomy (Archer & Van Wyk 1992, 1993a, 1993b). Provisional observation on fruit and seed structure and anatomy were only briefly mentioned in Archer (1990). Full details of these observations, as well as those on leaf anatomy, have not yet been published.

4.1 **Palynology (Appendix 6)**

The Celastraceae were considered stenopalynous by Erdtman (1966). Subsequently extensive palynological studies on the Celastrales, including many members of Celastraceae as well as Cassinoideae were conducted, mainly by Lobreau-Callen (1975). SEM studies have made possible a major advance in the study of celastraceous pollen grain. Archer & Van Wyk (1992) found three pollen types that are to some extent congruent with supraspecific groups. Taxa with type A pollen (reticulate grains) are *Mystroxylon, Robsonodendron, Cassine, Maurocenia* and one member of *Elaeodendron*. Most species can be distinguished by slight variations in exine ornamentation. Similar reticulate grains are, however, widespread in Celastraceae and their presence therefore does not necessarily signify close taxonomic affinity, particularly at generic level. Pollen grains of *Robsonodendron eucleiforme* and *R. maritimum* have a relatively thin exine, which may be employed, amongst other characters, to distinguish this genus from *Mystroxylon*.

Type B pollen (foveolate/psilate grains) occur in *Lauridia* and *Allocassine*. The pollen of *Allocassine* has conspicuous endexine folds compared with that of *Lauridia*.

Palynology clearly supports the recognition of these two genera. Pollen of *Pleurostylia*, which also fits this pollen type, is smooth and irregularly foveolate (unpublished results).

Type C pollen (rugulose-reticulate grains) is distinctive and unlike any other known in Celastraceae. Taxa with this pollen type include species of *Elaeodendron* that Robson (1965, 1966) and Archer (1990) proposed to include in a segregate genus closely related to *Elaeodendron*. This genus (*Crocoxylon auct.*), could also be advocated on the basis of flower morphology (Archer 1990). Several tropical African and extra-African species are intermediate (in pollen structure as well as flower morphology) between *Elaeodendron* and Robson's concept of *Crocoxylon*. Unfortunately the genus *Elaeodendron* is not yet well known palynologically and at this stage it is difficult to reach definite conclusions on the merits of recognizing a segregate genus.

4.3 **Bark anatomy (Appendix 7)**

Comparative bark anatomical studies on members of the Celastraceae are scanty. Available studies are summarized by Archer & Van Wyk (1993a). As an aid towards the classification of woody taxa, the potential taxonomic significance of bark anatomy has been neglected. The bark anatomy of various celastraceous species hitherto investigated, suggests that bark structure could contribute more than wood structure towards the delimitation of supraspecific taxa (Archer 1990 and unpublished results).

Observations on bark anatomy (Archer 1990; Archer & Van Wyk 1993a) are extremely useful for the subdivision of the southern African Cassinoideae. Bark of the investigated species was grouped into six distinct anatomical types (Table 2.). The different bark types show remarkable congruence with the generic delimitation of Loesener (1942a) and Robson (1965, 1966). The bark structure of *Pleurostylia*, which was not included in the original studies (Archer 1990; Archer & Van Wyk 1993a), comprises a distinct seventh type related to type E (*Lauridia* and *Maurocenia*). It consists of broad oval to irregular groups of densely packed lignified chambered crystalliferous strands, and a well developed rhytidome with ramified periderm (unpublished results).

4.3 **Wood anatomy (Appendix 8)**

Wood structure of several species of Celastraceae was described in varying detail by authors such as Record (1938) and Metcalfe & Chalk (1950). They also summarized most of the older literature. However, little work was done on southern African celastraceous species. The presence of vessel elements with scalariform perforation plates in *Elaeodendron* was employed by Loesener (1942a) to justify its separation from *Cassine s.l.* Single perforations prevail in the rest of the family. Considerable confusion exists regarding the taxonomic usefulness of the presence of scalariform perforation plates in *Elaeodendron* and *Cassine s. str.* The inconsistent application of generic names to southern African species (e.g. Metcalfe & Chalk 1950), led to the misconception that scalariform perforation plates occur in both genera.

Broad bands of either parenchyma or septate fibres are characteristic of many of the investigated genera of Cassinoideae, Celastroideae, Hippocrateoideae *s. str.* and Salacioideae (Metcalfe & Chalk 1950; Mennega 1972).

Three distinctive wood anatomical types, one with three subtypes, were distinguished by Archer (1990) and Archer & Van Wyk (1993b), mainly using the presence or absence of scalariform perforation plates and bands of either septate fibre-tracheids or axial parenchyma. Other useful characters are the ray type and, to a lesser degree, the length of the vessel elements and fibres. The taxa and the wood types recognized by Archer & Van Wyk (1993b) are summarized in Table 2.

Since the completion of my M.Sc. thesis (Archer 1990), where I doubted the generic identity of *Elaeodendron orientale* Jacq., the type species of the genus, on the grounds of wood anatomy, I have had the opportunity to study authentic material collected in the Mutare Botanical Gardens in Zimbabwe. Wood anatomical features of this species agree closely with southern African and other extra-African species of *Elaeodendron.* I therefore have no doubts about maintaining the African species in *Elaeodendron.*

Table 2. Summary of different taxonomic treatments of southern African Cassinoideae, wood, bark and pollen types, and a proposed new generic classification. Table adapted from Archer & Van Wyk (1993b). For an explanation of pollen and anatomical types, see Appendices 6–8.

Species of southern African Cassinoideae: *Cassine s. l.*[1]	Alternative generic treatment[2]	Wood type	Bark type	Pollen type	Proposed new generic treatment
Cassine crocea auct non Thunb.	*Crocoxylon* Eckl. & Zeyh.	A	A1	C	*Elaeodendron* Jacq.
C. transvaalensis (Burtt Davy) Codd					
C. matabelica (Loes.) Steedman	*Elaeodendron* Jacq.				
C. papillosa (Hochst.) Kuntze[3]				A	
C. barbara L.	*Cassine s.str.*	B1	C		*Cassine* L.
C. parvifolia Sond.					
C. peragua L.					
Hartogiella schinoides (Spreng.) Codd	*Hartogiella* Codd				
Maurocenia frangula Mill.[4]	*Maurocenia* Mill.	B2	E		*Maurocenia* Mill.
C. tetragona (L. f.) Loes.[5]	*Allocassine* N. Robson			B	*Lauridia* Eckl. & Zeyh.
C. reticulata (Eckl. & Zeyh.) Codd	*Lauridia* Eckl. & Zeyh.				
Allocassine laurifolia (Harv.) N. Robson	*Allocassine* N. Robson	B3	D		*Allocassine* N. Robson
C. aethiopica Thunb.	*Mystroxylon* Eckl. & Zeyh. sect. *Eumystroxylon* Loes.	C	A2	A	*Mystroxylon* Eckl. & Zeyh.
C. burkeana (Sond.) Kuntze					
C. eucleiformis (Eckl. & Zeyh.) Kuntze	*Mystroxylon* Eckl. & Zeyh. sect. *Pseudoscytophyllum* Loes.		B		*Robsonodendron* R.H. Archer
C. maritima (H. Bol.) L. Bol.					
Pleurostylia capensis (Turcz.) Loes.	*Pleurostylia* Wight & Arn.		E?	B	*Pleurostylia* Wight & Arn.

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[1] Adapted from Arnold & De Wet (1993), following Davison (1927), Codd (1966, 1983).

[2] E.g. Loesener (1942a), Robson (1965, 1966).

[3] Referred to as *Elaeodendron croceum* in text. The past misuse of the name was a major source of confusion.

[4] Both the specific epithet and the author citation is incorrectly used.

[5] The correct author citation should be '(L. f.) Druce'.

4.4 **Leaf epidermis and stomatal structure**

The use of leaf anatomy, particularly stomatal characters, as taxonomic criteria is well established in comparative anatomical studies (Stace 1989). However the use of leaf anatomical evidence has hitherto been neglected in systematic work on the Celastraceae. Notable is the work of Den Hartog-Van Ter Tholen & Baas (1978), with contributions on the epidermal structure of about 42 genera of Celastraceae. Other contributions on leaf anatomy are scanty and are mostly summarized by Metcalfe & Chalk (1950). It is nevertheless clear from these observations that leaf anatomy holds considerable promise as a useful source of taxonomic evidence in the Celastraceae.

In leaf epidermal characters, Archer (1990) considered the presence of crystalliferous epidermal cells, the type of stomata, the shape of epidermal cells in transverse section and, to a lesser extent, the presence of hairs and undulating cell walls with depressions, as taxonomically significant in southern African Celastraceae. Other taxonomically useful leaf anatomical characters are the presence and form of hypodermis, the absence or presence of elastic threads and, probably related to the latter, the lack of extraxylary fibres around the vascular bundles.

The presence of prismatic crystals of calcium oxalate in the epidermis seems highly significant in separating *Elaeodendron* from *Cassine s. str.* and most other Cassinoideae (Archer 1990; unpublished results). Likewise the presence of hairs on leaves of species of *Mystroxylon* distinguishes them from all other southern African Cassinoideae, which are completely hairless. This, together with the presence of laterocytic stomata, supports the recognition of the segregate genus *Mystroxylon.*

Latero-cyclocytic stomata are present in the species of *Robsonodendron.* In addition, leaves of these species lack extraxylary fibres, possess conspicuous elastic threads, and have palisade-like epidermal cells (Archer 1990). This combination of leaf characters strongly supports the recognition of the new segregate genus, *Robsonodendron.*

Undulating anticlinal cell walls and depressions in cuticular flanges characterize two genera, *Allocassine* and *Lauridia,* and also correlate with various other morphological and anatomical features. The monotypic genus, *Maurocenia,* is clearly distinct on account of its well developed hypodermis and cyclocytic stomata with differentially staining subsidiary cells. Among species of *Cassine s. str.* few constant interspecific anatomical differences of taxonomic value were found by Archer (1990).

4.5 **Macromorphology**

Habit: Celastraceae is a family of mostly woody members. Most species of Cassinoideae are shrubs to medium-sized or tall trees. *Cassine parvifolia, Lauridia reticulata* and *Robsonodendron maritimum*, long considered to be shrubs only, were found to be small trees and qualified to be included in future revisions of the *National List of Trees* (Von Breitenbach *et al.* 1987). *Allocassine* and *Lauridia tetragona* are described as small trees in most popular tree guides, however, these two taxa are exceptional in the southern African Cassinoideae in having a climbing habit. Side branches of *L. tetragona* are usually deflexed and this is clearly an adaptation to its climbing habit. However, the stem anatomy of the two species has little resemblance to each other or to that of the lianas in the Hippocrateoideae and Salacioideae.

Leaves: Sterile material of most species of the Cassinoideae can be easily recognized by experienced taxonomists. However, little emphasis is placed on detailed leaf macromorphological features in the present study. Even within a species, leaf characters may be very variable. *Mystroxylon aethiopicum* and *Lauridia tetragona* are two species showing considerable infraspecific variation in leaf shape. Species in unrelated groups may have a close resemblance in general facies to each other. Leaf characters useful for the delimitation of genera, are the type of phyllotaxy and the presence/absence of hairs and elastic threads.

Elastic threads (*trans*-1, 4-polyisoprene) are found in the species of *Robsonodendron*, in three southern African species of *Maytenus* Molina (Celastroideae) as well as some species of *Salacia* L. (Salacioideae). Its presence is easily observed when a twig, leaf lamina or piece of bark is broken and gently pulled apart, and distinguishes the species of *Robsonodendron* from the other Cassinoideae.

Inflorescences: Inflorescences in the southern African Cassinoideae are usually compound dichasia, occasionally with dense cymules, or fasciculate. *Lauridia* was kept separate from the other Cassinoideae by Davison (1927) on account of its ‘unique (in Celastraceae) racemose inflorescences’. It is shown in the present study that the inflorescences of the two species now recognized in *Lauridia* are structurally similar in being thyrsoid with a determinate (*L. tetragona*) or indeterminate (*L. reticulata*) axis. Flowers of *Allocassine* and *Lauridia* are sessile, whereas those of the remaining taxa are pedicellate.

Flowers: Flowers in the Celastraceae tend to be small, and in the past provided relatively few useful taxonomic characters. Taxonomically important floral characters in the southern African Cassinoideae include the position of ovule attachment, number of floral parts, shape of the disc, and the shape and dimensions of the sepals. Little attention has been given to comparative embryology.

Cronquist (1981) keys the family Celastraceae and the closely related families out by, amongst other characters, the erect ovules. However, *Maurocenia*, and two American genera of the Cassinoideae, *Gyminda* Sargent and *Tetrasiphon* Urban have apically pendulous ovules (Loesener 1942a; Brizicky 1964). This could indicate some relationship between the genera mentioned. It also illustrates the isolated position of *Maurocenia* amongst the other southern African Cassinoideae.

The number of flower parts (three to five (six)-merous) varies considerably between species and genera, especially in *Elaeodendron*. Robson (1965, 1966) resurrected *Crocoxylon* on account of the isomerous flowers with stamens on the disc, instead of outside. *Elaeodendron matabelicum* and other extra-African species of *Elaeodendron* with meiomerous flowers, however, are closely related to the species of *Crocoxylon auct.*, which makes it difficult to maintain the distinction. However, these and other floral characters such as the shape of the disc and the extrorse stamens, as well as the interlaced rugulose-reticulate pollen tectum, need careful evaluation in a monographic study of *Elaeodendron*. The number of ovules per locule in the Cassinoideae is always two, except in *Pleurostylia*, which has two to four (or possibly eight).

Fruit: In the Celastraceae, only the texture of the fruit (fleshy or dry) and its dehiscence is usually recorded in descriptions. The precise fruit type in species of Cassinoideae has, however, been much neglected. Surprisingly, the fruit of *Cassine s.l.* has been generally described as drupaceous (Sonder 1860; Davison 1927; Loesener 1942a and Dyer 1975). Robson first recognized baccate fruit when proposing the new genus *Allocassine*. Archer (1990) recognized four morphologically distinct fruit types among the southern African Cassinoideae. These types are easily recognizable, even when immature, and are extremely useful in the identification of fruiting material. The five fruit types recognized in the present study are:

a Globose berries with a fleshy pericarp. Usually red or brown. *Cassine s. str.*, *Lauridia* and *Maurocenia*. The fruit of *Cassine schinoides* appears hard and leathery owing to the formation of irregularly arranged sclereids in the mesocarp.

b Ellipsoid berries with a thick, leathery pericarp. Red. *Allocassine*.

c Spheroid drupes with a thin lignified endocarp *s. str.* (not to be confused with lignified mesocarp, e.g. in *Mystroxylon*) consisting of one or two layers of palisade-like sclereids, occasionally with an additional layer of isodiametric sclereids. The endocarp can be easily separated from the mesocarp. Fruit white or yellow (*Robsonodendron*) or red (*Mystroxylon*).

d Lopsided, ellipsoid drupes, the scar of the stigma on the side below the middle. Pericarp thin and leathery, ± 1 mm thick, with fibrous bands arranged lengthwise on inside of the pericarp. Fruit pale brown. *Pleurostylia*.

e Spheroid or ellipsoid drupes with a hard thick endocarp or putamen. Ripe fruit white or cream. *Elaeodendron*.

The inner portion of the mesocarp in some species may undergo varying degrees of lignification, in extreme cases resulting in a thick, solid layer of sclereids, which can be confused with a stony endocarp or putamen. Such a sclerified layer (or layers) is, however, not homologous with a true endocarp *s. str.*, which, by definition, must take its origin from the inner epidermis of the pericarp only. This feature is most conspicuous in *Mystroxylon aethiopicum*.

Seed: The Celastraceae has been considered a family in which the seed coat shows much diversity (Corner 1976; Archer 1990). Five types of seed coat are recognized by Archer (1990), which correlate largely with the segregate genera proposed in this study.

Alleged differentiating seed characters of the monotypic genus *Hartogiella,* namely the presence of golden papillae, absence of endosperm (Dyer 1975) and presence of an arillus (Von Breitenbach 1965), have not been confirmed by the present study. The only seed character that may differentiate *Hartogiella* and *Cassine s. str.* is the presence of starch in the endosperm and cotyledons of the former. This is perhaps a physiological adaptation to a drier habitat. The phenomenon requires further study. Although *C. schinoides* is an easily distinguishable species in the field, it is remarkable similar in most characters to the other species of *Cassine s. str.,* especially *C. parvifolia.*

CHAPTER 5

TAXONOMIC TREATMENT

KEY TO THE AFRICAN GENERA OF THE CASSINOIDEAE

A Fruit drupaceous; ovary 2–4-locular; ovules 2 per locule; leaves alternate, opposite or fasciculate (if opposite then sepals small, ± 1 mm long, ± subcircular with margin entire):

B Endocarp thin and crustaceous; sepals ± deltoid with margin laciniate; leaves alternate, pubescent or glabrous:

C All parts glabrous; elastic threads (trans-1, 4 polyisoprene) present in leaf and bark (conspicuous when pieces of leaf are pulled apart); sepals unequal, outermost sepals larger than inner sepals; ovary 2-locular; ripe fruit white or yellow . . . . *Robsonodendron*

C Leaves, young stems and inflorescences pubescent; elastic threads absent; sepals of equal size; ovary 3- or 4-locular; ripe fruit red or yellow brown, tinged with red . . . . *Mystroxylon*

B Endocarp thick and woody (stone); sepals ± subcircular with margin entire; leaves usually opposite or fasciculate, glabrous . . . . *Elaeodendron*

A Fruit baccate or small and nutlike; ovary 1, 2 or 3-locular; ovules 2 or 2–4 (rarely more) per locule; leaves opposite or subopposite, rarely alternate:

D Ovary 2- or 3-locular; ovules 2 per locule; fruit baccate; leaves usually opposite:

E Ovules pendulous; sepals vestigial; leaves coriaceous with margin revolute . . . . *Maurocenia*

E Ovules erect; sepals normal; leaves variously textured with margin plane or occasionally revolute:

F Shrubs or trees; inflorescence a compound dichasium; flowers pedicellate; ovary 2–3-locular; ripe fruit light to dark brown or purplish, succulent or ± fleshy . . . . *Cassine*

F Lianes, scrambling shrubs, or small trees; inflorescence thyrsoid with simple or compound cymules arranged along the rachis; flowers sessile; ovary 2-locular; ripe fruit red or purple, fleshy or leathery:

G Lianes or scrambling shrubs; leaves opposite to alternate; sepals triangular, coriaceous; flowers 5-merous; berries elliptic . . . . *Allocassine*

G Liane, scrambling shrub or small tree; leaves opposite; sepals ± suborbicular, fleshy; flowers 4- or 5-merous; berries spheroid . . . . *Lauridia*

D Ovary with 1 fertile locule; ovules 2–4, rarely more; fruit small, nutlike and lopsided with a persistent lateral style or stylar scar, pericarp thin and dry; leaves strictly opposite . . . . *Pleurostylia*

5.1 *CASSINE* L.*

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A taxonomic revision of *Cassine* L. *s. str.* (Cassinoideae: Celastraceae)

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Cassine L. in southern Africa has been treated in a wide sense, as comprising several segregate genera, such as *Elaeodendron* Jacq., *Lauridia* Eckl. & Zeyh., *Mystroxylon* Eckl. & Zeyh. and *Cassine s. str.* New evidence from palynology, macromorphology and anatomy supports the subdivision of *Cassine s.l.* into smaller, more homogeneous taxonomic units. *Cassine* in the strict sense, as revised here, includes three species, one with three subspecies, of shrubs or trees endemic to southern Africa. Most non-southern African species (approximately 30) previously referred to *Cassine s.l.* are best accommodated in *Elaeodendron*. The monotypic genus, *Hartogiella* Codd, is not upheld but sunk under *Cassine*.

Introduction

Linnaeus (1753) based the genus *Cassine* on two southern African species, *C. peragua* L. and *C. maurocenia* L. (now *Maurocenia frangula* Mill.). Subsequently additional new, though closely related genera of southern African Cassinoideae were described by mainly Miller (1754), Jacquin (1782) and Ecklon & Zeyher (1834/5).

In a principal work on the classification of the Celastraceae, Loesener (1942a) referred all the species with drupe-like fruit to the tribe Eucassineae, which in turn was placed under the Cassinoideae, a subfamily characterized by the indehiscence of the fruit (Loesener's concept excluded the Hippocrateaceae). The Eucassineae comprises about 19 genera of which 7 are wholly or partly confined to southern Africa, namely *Cassine*, *Elaeodendron* Jacq., *Hartogia* L.f. *non* L. (now *Hartogiella* Codd but no longer upheld), *Lauridia* Eckl. & Zeyh., *Maurocenia*, *Mystroxylon* Eckl. & Zeyh. and *Pleurostylia* Wight & Arn. In addition, a monotypic genus, *Pseudocassine* Bredell, was treated separately in the Hippocrateaceae (Loesener 1942b). Since Loesener's (1942a) monograph, the taxonomic status and interrelationships of the genera of the Eucassineae have received little attention, despite obvious disagreement on the generic circumscription of *Cassine*. Robson (1965, 1966), while more or less retaining Loesener's (1942a) concepts, added a new genus *Allocassine* N. Robson and reinstated *Crocoxylon* Eckl. & Zeyh.

A recent multidisciplinary research project (Archer 1990; Archer & Van Wyk 1992, 1993a, 1993b), covering different aspects of anatomy, morphology and palynology has shown that *Cassine*, as currently circumscribed, is an extremely artificial taxon and should be best subdivided into smaller, more distinct and homogeneous units. These proposed units correspond closely with previously described genera.

In this study, *Cassine* is restricted to five taxa, confined to southern Africa, especially the Western Cape. Two of the presently recognized species of *Cassine s.l.* are retained in *Cassine s. str.*, namely *C. peragua* L. (with three subspecies) and *C. parvifolia* Sond. The monotypic genus *Hartogiella* Codd is now reduced to synonymy under *Cassine*.

Typification of *Cassine*

Linnaeus recognized *Cassine* and *Maurocenia* as separate genera in the first edition of his *Genera Plantarum* (1737). However, in 1753 he based *Cassine* on two southern African species, *C. peragua* and *C. maurocenia* (now *Maurocenia frangula* Mill.). Although *C. maurocenia* forms the basis of Miller's (1754) reinstated *Maurocenia*, Hitchcock & Green (1929) chose this taxon as the lectotype of *Cassine*. Jarvis (1992) proposed the conservation of *C. peragua* as the lectotype of the genus, thereby avoiding the need for a new name for *Cassine*.

Taxonomic status of *Cassine*

Today, *Cassine* is usually treated as a large and inclusive genus, containing amongst others, *Elaeodendron* Jacq., *Lauridia* Eckl. & Zeyh., *Crocoxylon* Eckl. & Zeyh. and *Mystroxylon* Eckl. & Zeyh. Only two monotypic genera, *Allocassine* and *Maurocenia* remain in common use in southern African herbaria. This broad concept of *Cassine* has been adopted, perhaps uncritically, by many recent workers world-wide, e.g. Borhidi & Muñiz (1975), Coates Palgrave (1977), Ingram (1975), Lobreau-Callen (1975), Jessup (1984), Coates Palgrave *et al.* (1985), Kostermans (1986), Mabberley (1987) and Sasidharan & Swarupanandan (1992). Although it has become almost customary to use *Cassine* in a broad sense, there are still authors who prefer to retain at least some segregate genera, e.g. Robson (1965, 1966, 1989), Robson & Sousa (1969), Robson *et al.* (1994), Willis (1973), Morley & Tölken (1983), Robertson (1989), Zhang Zinying *et al.* (1990) and Green (1994).

Considering the many revisionary studies on this group, the controversy surrounding the application of generic limits in *Cassine* is surprising. However, past efforts to distinguish between the various segregate genera of *Cassine s.l.* have unfortunately not always been based on taxonomically sound macromorphological characters. The distinguishing characters employed by most authors were often inconsistent and difficult to apply to all species of a group. This lack of good morphological and anatomical evidence to differentiate between genera has further contributed to the conflicting opinions regarding the generic limits of the Celastraceae in general, and of *Cassine* in particular. Furthermore, considerable confusion has been observed in the literature about the diagnostic characters employed in the past to distinguish segregate genera. Such an example is the type of perforation plates in wood tissue. The wood of *Elaeodendron* is reportedly characterized by vessels with scalariform perforation plates (Moll & Jansonius 1908, Record 1938, Loesener 1942a), whereas simple perforations apparently prevail in the rest of the family. Owing to inconsistent application of the generic names *Cassine* and *Elaeodendron* to southern African taxa (Metcalfe & Chalk 1950, Blakelock 1956), it was surmised that scalariform perforation plates occur in both genera. However, Archer (1990) and Archer & Van Wyk (1993b) confirmed the fundamental taxonomic value of the scalariform perforation plates and other wood anatomical characters in distinguishing between *Cassine* and *Elaeodendron*.

So far, in the present study on the Cassinoideae, which was undertaken in an attempt to gain a better understanding of this taxonomically complex group (Archer 1990; Archer & Van Wyk 1992, 1993a & 1993b), several other anatomical and morphological features have provided unequivocal criteria for distinguishing between a number of supraspecific taxa. Notable are the wood and bark structural types, presence or absence of leaf epidermal crystals, stomatal type and fruit and seed structure, as well as pollen type. Some of the segregate genera now recognized, are listed in Table 2, together with some of the characters employed to distinguish between them. Furthermore, it has been demonstrated that the sets of differentiating characters from various sources show complete correlation within the proposed groups and discontinuity between the groups (Archer 1990). Most of these groups correspond well with previously described segregate genera, although with some modifications of the generic limits originally defined. Loesener (1892, 1942a) recognized two subgenera in *Cassine, Eucassine* Loes. and *Maurocenoides* Loes.

The monotypic genus *Hartogiella*, created by Codd (1983) to replace the illegitimate *Hartogia* L.f. *non* L., is loosely circumscribed and often difficult to distinguish clearly from certain forms of *C. peragua* in the Western Cape. Particularly herbarium specimens are occasionally difficult to identify correctly. Except for the presence of starch in the endodermis and cotyledons, and the occasional presence of clusters of raphides in the leaf epidermis, Archer (1990) found no constant anatomical or morphological supraspecific differences between *Hartogiella* and the species of *Cassine s. str.* Although many authors advocated the concept of the inclusive genus *Cassine*, curiously nobody had seriously considered the possible inclusion of *Hartogiella* in *Cassine*. Codd (1966) did mention this possibility but then mentioned alleged differences between the two genera that needed to be examined. However, in 1983, realizing that *Hartogia* is illegitimate, Codd erected the new name *Hartogiella.*

Since *C. peragua* (a Cape species) is the type species of *Cassine*, the re-definition of the genus necessitates name changes to *Elaeodendron* for most species of *Cassine s.l.* from other parts of the world. Fortunately most species have been well known under *Elaeodendron*, and in perhaps most cases combinations already exist under this genus. Approximately 30 species of *Elaeodendron* can be recognized from Central America, Africa, Asia and Australasia.

Systematic treatment

Cassine L., Genera Plantarum ed. 5: 129 (1754); DC.: 11 (1825), *pro parte,* excl. *C. maurocenia*; Sond.: 465 (1860); Davison: 326 (1927); Loesener: 223 (1892); 214 (1897), *pro parte,* excl. subgen. *Elaeodendron* sect. *Euelaeodendron*, subgen. *Mystroxylon*; 176 (1942a); Von Breitenbach: 632 (1965); Codd: 123 (1975); Palmer & Pitman: 1307 (1973); Dyer: 334 (1975); Coates Palgrave: 508 (1977); *non* Hook. f.: 363 (1862); Sim: 181 (1907). Type: *C. peragua* L. (Jarvis: 559 (1992), *typ. cons. prop.*).

Cassine L. subg. *Elaeodendron* sect. *Eucassine* Loes.: 215 (1892). Type: *Cassine peragua* L.

Cassine L. subg. *Eucassine* Loes.: 223 (1897); 176 (1942a). Type: *Cassine peragua* L.

Cassine L. subg. *Maurocenoides* Loes.: 223 (1897); 176 (1942a). Type: *Cassine parvifolia* Sond.

Hartogia L. f.: 16 (1782), *non* L. (1759); *nec* Hochst.: 32 (1844[1846]); *nec* Kunth: 100 (1891); DC.: 12 (1825); Sond.: 464 (1860); Benth. & Hook. f.: 363 (1862); Davison: 345 (1927); Loesener: 179 (1942a); Von Breitenbach: 640 (1965); Palmer & Pitman: 1325 (1973); Dyer 335 (1975); Coates Palgrave: 515 (1977). Type: *H. capensis* L. f.: 128 (1782), *non* L. (1759).

Schrebera Thunb.: 28 (1794), *non* L. (1762); Endl.: 1088 (1840). Type: as for *Hartogia* L. f.

Hartogiella Codd: 124 (1983); Bond & Goldblatt: 224 (1984). Type: *H. schinoides* (Spreng.) Codd.

Slender to tall evergreen trees, shrubs or suffrutices, unarmed, glabrous, without elastic threads in bark and leaves; bark with yellow pigment usually present or hardly discernible. *Branchlets* 4-lined to subangular. *Leaves* opposite or rarely subopposite; stipules minute, ± 1 mm, triangular, brownish black, marcescent. *Inflorescences* pedunculate or sessile, axillary, dichasial. *Flowers* usually bisexual, 4- or 5-merous, pedicellate. *Sepals* equal, ovate or deltoid to suborbicular, margin ciliolate or laciniate. *Petals* cream to white, elliptic to oblong, spreading, margin entire. *Stamens* ± spreading or erect, arising from the margin of sinuses in the disc with which they are united at the base, anthers introrse or occasionally extrorse, dehiscing by longitudinal slits. *Disc* fleshy, lobed or entire. *Ovary* ± ⅓ immersed and adnate to the disc, 2- or 3-locular, with two erect collateral ovules per locule; style short or absent, stigma usually conspicuously 2- or 3-lobed. *Fruit* baccate, mesocarp fleshy or leathery, spheroid, ± 10 mm in diam., brown to dark brown or purplish. *Seeds* 1 or 2(–6), spheroid to ellipsoid, seed-coat brown; postchalazal vascular bundles not observed; fleshy endosperm present; embryo erect with cotyledons fleshy, widely elliptic to circular.

Key to the species and subspecies

1a Lamina elliptic to widely elliptic or circular, venation conspicuous (translucent when viewed against light) above and below [the venation of subsp. *affinis* less conspicuous in fresh material] . . . . 1. *C. peragua*

2a Lamina widely elliptic to circular to broadly obovate, stiff and brittle, base rounded to cordate or rarely attenuate, apex rounded to obtuse; shrub (often rhizomatous); in coastal scrub of the Western Cape between the Cape Peninsula and Bredasdorp . . . . 1b. *C. peragua* subsp. *barbara*

2b Lamina elliptic to obovate, base cuneate, apex caudate to rounded; small multi-stemmed shrub or tree; in riverine fringes in Calvinia and Cederberg area of Western Cape . . . . 1c. *C. peragua* subsp. *affinis*

2c Lamina elliptic to obovate, base attenuate, apex acute to rounded; shrub to tall tree in forest margin or riverine fringes in Northern Province, Mpumalanga, KwaZulu-Natal and Eastern and Western Cape . . . . 1a. *C. peragua* subsp. *peragua*

1b Lamina narrowly elliptic, venation inconspicuous below:

3a Suffrutex or small tree; leaf margin revolute, lamina narrowly elliptic to elliptic, midrib inconspicuous above; ripe fruit brown to purplish, pericarp fleshy; Ceres and George distr., Western Cape . . . . 2. *C. parvifolia*

3b Slender tree; leaf margin ± plane, lamina narrowly elliptic to obovate, midrib prominently raised above; ripe fruit brown, pericarp leathery; Western Cape . . . . 3. *C. schinoides*

1. ***Cassine peragua*** **L.** Species Plantarum: 268 (1753); *non* L.: 220 (1771); Mill.: CAS (1768); Loes.: 155 (1900); Adamson: 567 (1950); Robson: 36 & 37 (1965); Ross: 232 (1972); Palmer & Pitman: 1317 (1973); Von Breitenbach: 226 (1974); Compton: 338 (1976); Coates Palgrave: 512 (1977); Bond & Goldblatt: 223 (1984); Coates

Palgrave *et al.*: 65 (1985); Pooley: 278 (1993). Type: Dillenius, Hortus Eltham. t. 236, f. 305 (1732), lecto., designated by Jarvis: 559–560 (1992).

Icones: Von Breitenbach: 226 (1974); Coates Palgrave *et al.*: 65 (1985), photo; Pooley: 279 (1993), photo.

Shrub, often rhizomatous or slender to tall evergreen tree up to 15 m high; bark greyish with yellow pigment present or hardly discernible, surface fairly smooth or minutely cracked into fine, generally longitudinal lines, rhytidome exfoliating in thin scales. *Branchlets* ± 4-lined when young, becoming terete, greyish brown. *Leaves* opposite; lamina elliptic to broadly elliptic to obovate, or circular, pale or dark green above, grey-green below, 20–80 x 10–40 mm, base narrowly cuneate, attenuate or rounded, apex rounded to retuse or caudate, margin glandular-crenate, crenations 6–14 on each side, subcoriaceous or very stiffly coriaceous; venation conspicuous in dried material, conspicuous or inconspicuous in fresh material, ± raised above and below in dried material, indistinctly eucamptodromous; petiole 1–12 mm long. *Inflorescences* pedunculate, dichasial, ± axillary towards the apices of branchlets, 5–25-flowered; peduncle 5–15 mm long, bracts minute. *Flowers* usually bisexual (rarely functionally unisexual), 4- or 5-merous, ± 5 mm diam.; pedicels 2–4 mm long. *Sepals* greenish, ovate to deltoid, 0.8–1.5 x 0.8–1 mm, margin ciliolate. *Petals* cream, oblong, 2.5–3 x 1.5–2 mm, sessile, apex rounded, margin entire, ± spreading. *Stamens* erect or spreading; filaments 1.2–1.5 mm long, arising from prominent sinuses in the disc, anthers ± 0.5 mm long, dorsifixed or sub-basifixed, introrse, ± versatile. *Disc* ± fleshy, subentire with prominent sinuses at the point of stamen insertion. *Ovary* 2- or 3-locular; astylous or styles ± 0.25 mm long; stigma conspicuously 2- or 3-lobed. *Fruit* light brown or brown to purplish when ripe, spheroid to obovoid, 5–15 mm diam., mesocarp fleshy. *Seeds* 1–6 per fruit, seed-coat brown, spheroid; embryo erect, with cotyledons fleshy, widely elliptic.

1a. ***Cassine peragua* subsp. *peragua***

Cassine capensis L.: 220 (1771); Thunb.: 52 (1794); 226 (1818); 269 (1823); Eckl. & Zeyh.: 128 (1834/5); Sond.: 466 (1860). Type: as for *C. peragua*.

Euonymus colpoon L.: 210 (1771). *Cassine colpoon* (L.) Thunb.: 52 (1794); 227 (1818); Eckl. & Zeyh.: 128 (1834/5). *Cassine capensis* L. var *colpoon* (L.) DC.: 12

(1825); Sond.: 466 (1860). Type: Burman, Rar. Afr. Plant. t. 86, f. 240 (1739), lecto., here designated.

Cassine kraussiana Bernh. in Krauss: 42 ([1844–]1846); Davison: 333 (1927); Henkel: 158 (1934); Von Breitenbach: 637 (1965). *Elaeodendron kraussianum* (Bernh.) Sim: 190 (1907). Type: 'montibus Winterhoek, Uitenhage, April, Alt. 3000' *Krauss 1792* (B†?, K, *n.v.*).

Cassine aethiopica auct. non Thunb.: Eckl. & Zeyh: 128 (1834–35).

Shrub, slender to tall evergreen tree up to 15 m high; bark greyish with layers of powdery yellow pigment in the exposed rhytidome, which exfoliates in thin scales. *Leaves* with lamina elliptic to broadly elliptic to obovate, pale green above, grey-green below, (20–) 25–45 (–75) x (10–) 15–30 (–40) mm, base attenuate, apex rounded to retuse, margin glandular-crenate, crenations usually 6–14 on each side, subcoriaceous; venation conspicuous in fresh and dried material; petiole 4–8 mm long. *Inflorescences* ± regularly dichasial, 10–20 flowered; peduncle ± 10 mm long. *Flowers* usually bisexual (rarely functionally unisexual), 4- or 5-merous, ± 5 mm diam.; pedicels 2–4 mm long. *Sepals* ovate, 1.5 mm x 1 mm. *Petals* ± 2.5 x 1.5 mm. *Stamens* ± erect; filaments ± 1.2 mm long, anthers ± 0.5 mm long. *Ovary* 2(3)- locular; styles ± 0.25 mm long; stigma conspicuously 2(3)-lobed. *Fruit* brown to purplish when ripe, spheroid, ± 10 mm diam. *Seeds* 1 or 2 per locule (up to 6 per fruit). (Plate 1 in frontispiece, Figure 1).

Cassine peragua subsp. *peragua* is a large shrub or tall tree in woodland, forest and forest margins. It is the most widespread taxon of *Cassine* and the only taxon occurring outside the Western Cape. It occurs infrequently in Northern Province, Mpumalanga and Swaziland, and is more frequent to abundant in KwaZulu-Natal, Eastern and Western Cape (Figure 6). Flowers and fruit are produced sporadically between February and July or between July and August in the winter and summer rainfall areas respectively.

Leaves of *C. peragua* subsp. *peragua* are reported to be toxic, and have caused death in animal trials (Watt & Breyer-Brandwijk 1962). Little is known about the toxic substances involved. Pappe (1854) described the wood as hard, tough but handsome when varnished, and used by cabinet makers and wheelwrights.

Sterile material of this subspecies may be confused with the capsular-fruited *Catha abbottii* Van Wyk & Prins, a rare species with a restricted distribution in southern KwaZulu-Natal and Pondoland. In *C. abbottii*, the stipules are large and free with their bases united interpetiolarly. The stipules are caducous and leave a conspicuous scar. In *C. peragua* the stipules are small and marcescent and lack the conspicuous interpetiolar scar of *C. abbottii* (Van Wyk & Prins 1987).

A common name for this subspecies is 'Cape Saffron' or 'Bastards Saffron', after the yellow pigment observed in exposed rhytidome of bark (Von Breitenbach 1987).

Selected specimens examined

Swaziland

—**2631** (Mbabane): Hills NE of Mbabane (–AC), *Compton 27044* (NBG, K).

South Africa

—**2229** (Waterpoort): Soutpansberg, 5 m. W of Wylies poort (–DD), *Hutchinson & Gillett 4400* (BM, K).
—**2430** (Pilgrim's Rest): Mount Sheba (–DC), *Kluge 995* (PRE).
—**2530** (Lydenburg): Ceylon Forest Reserve (–BA), *Deall 2279* (PRE); Barberton, Thorncroft Aloe Reserve (–DD), *Archer 238* (PRU).
—**2731** (Louwsburg): Ngome Forest (–CD), *Gerstner 5170* (PRE).
—**2830** (Dundee): Nqulu, near confluence of Buffalo & Tugela (–DA), *Gerstner 3530* (PRE); Qudeni Forest, Upper margin of forest (–DB), *Acocks 12324* (K, PRE).
—**2831** (Nkandla): Nkandla Forest (–CA), *Forest Off. FD 8638* (K, P, PRE).
—**2930** (Pietermaritzburg): Noodsberg (–BD), *Wood 868* (BM, GRA, MEL).
—**3029** (Kokstad): Ngeli (–DA), *Abbott 5318* (PRU).
—**3030** (Port Shepstone): Dumisa, Alexandria (–AD), *Rudatis 2132* (STE); Port Shepstone, Rossler's Gorge (–CC), *Balkwill 363* (K, PRE).
—**3128** (Umtata): Ntywenka Pass, 20 m. ESE of Maclear (–BA), *Acocks 12171* (PRE).
—**3129** (Port St Johns): Egossa (–BC), *Sim 2508* (BOL, GRA, PRE); Lupatana Gorge (–BD), *Nicholson 929* (PRE); Mount Thesinger (–DA), *Van Wyk 8379* (PRU).
—**3130**: (Port Edward): Clearwater (–AA), *Abbott 178* (PRE, PRU).

—**3226** (Fort Beaufort): 'Katrivier & Katberg' (–DA), *Ecklon & Zeyher* (B, C, MEL, Z, UPS).

—**3227** (Stutterheim): Fort Cunynghame (–AD), *Galpin 2467* (GRA, PRE); Keiskama Hoek, Mt. Kemp (–CB), *Killick 909* (PRE); Mt. Coke (–CD), *Sim 1521* (BOL); Komgha (–DB), *Flanagan 783* (GRA, PRE, Z).

—**3228** (Butterworth): Kentani, Manubi Forest (–BC), *Marais 477* (BOL, GRA, K, PRE); Qolora Mouth (–CB), *Pegler 1441* (BOL, PRE).

—**3318** (Cape Town): Kirstenbosch National Botanical Garden, Skeleton Gorge (–CD), *Marais 621* (GRA, K, P, PRE); Malmesbury, Paardeberg, above Modderkloof (–DB), *Rourke 473* (MO, NBG); Paarl Mountain, S face near Taalmonument (–DD), *De Villiers 166* (PRE).

—**3319** (Worcester): Du Toits Kloof Pass, W side of mountain (–CA), *Acocks 20340* (K, PRE).

—**3320** (Montagu): Barrydale, Tradouws Pass (–DC), *Marsh 1145* (PRE, STE).

—**3321** (Ladismith): Gamka Mountain Nature Reserve, upper Tierkloof (–CB), *Cattell & Cattell 242* (PRE, STE); Garcia Pass, Garcia State Forest (–CC), *Kruger 1261* (PRE, STE).

—**3322** (Oudtshoorn): George, 7 m. E of George (–DC), *Marais 699* (BOL, GRA, K, PRE).

—**3323** (Willowmore): Winterhoek Mountains (–BC), *Olivier 630* (GRA); Gouna Plateau (–CC), *Keet 575* (GRA, PRE); Keurbooms River Nature Reserve, Whiskey Creek (–CD), *Linger 80* (PRE); Blaauw Krantz Pass (–DC), *Fourcade 235* (BOL, GRA); Storms River Forest Reserve (–DD), *Dahlstrand 509* (C, J, MO, PRE).

—**3324** (Steytlerville): Baviaanskloof (–CA), *Bayliss BRI.B. 1463* (PRE); 13 m. SE of Joubertina on Karreedouw road (–CC), *Marais 714* (GRA, PRE); 6 m. S of Boplaats (–CD), *Story 2473* (GRA, K, PRE); Loerie road from Hankey (–DD), *Bayliss BRI.B. 6319* (PRE).

—**3325** (Port Elizabeth): Uitenhage, 15 m. up Elands R. road (–CA), *Acocks 21071* (K, PRE); Van Staden's Flower Reserve (–CC), *Dahlstrand 2759* (GRA, MO, PRE, STE); Uitenhage (–CD), *Cooper 1510* (BM, K, PRE, Z); Baakens River Valley (–DC), *Bolus 2224* (BOL).

—**3326** (Grahamstown): Farm 'Willowfountain', Riebeek East (–AA), *Bayliss BRI.B. 1016* (PRE); Proctorsfontein Farm, 28 m. from Grahamstown on Alicedale road (–AC), *Marais 885* (GRA, K, PRE); Slaaikraal Farm, Forest patch near Highlands road (–AD), *Wells 2973* (GRA, PRE); Trumpeters Drift (–BB), *Bayliss BRI.B. 1385* (PRE); Grahamstown (–BC), *Schlechter 2674* (BM, BOL, GRA, K, MEL, NBG, P, PRE, S, UPS, Z); Southwell (–DA), *Bayliss 3232* (MO, NBG, Z); Port Alfred, Rainbow Caravan Park (–DB), *Olivier 680* (PRU).

—**3327** (Peddie): Fort Pato, East London (–BA), *Rattray 656* (GRA); Fort Grey (–BB), *Galpin 7818* (PRE).

—**3418** (Simonstown): Chapman's Peak, lower slopes (–AB), *Marais 613* (BOL, GRA, K, PRE); 1.5 km WSW from Palmiet River Mouth, Seashore (–BD), *Van Wyk 1115* (K).

—**3419** (Caledon): Vogelgat Kloof, above Reflection pool (–AD), *Williams 2752* (K, MO, NBG, PRE, S).

—**3420** (Bredasdorp): Bontebok National Park (–AB), *Acocks 22243* (PRE); Wydgelegen P.O., 2 m. S of P.O. in kloof (–AD); *Acocks 23179* (K); Grootvadersbosch (–BB), *Taylor 734* (NBG); Potberg mountain, kloof at S side of mountain near Buffelsfontein (–BC), *Burgers 2012* (PRE, STE); Die Poort between Bredasdorp and Mierkraal (–CA), *Taylor 10413* (PRE).

—**3421** (Riversdale): Duiwenhoks River, farm Kleinfontein near mouth (–AC), *Taylor 2732* (BOL, S, STE); Olienbos, W of Still Bay, (–AD), *Taylor 10441* (K, PRE, STE); Ystervarkpunt (–BC), *Willemse 186* (PRE, STE).

—**3422** (Mossel Bay): Skaapkop River Mouth (–AB), *O'Callaghan, Fellingham & Van Wyk 159* (PRE, STE); Knysna, Belvedere (–BB), *Duthie 34* (GRA).

—**3423** (Knysna): Knysna, low coast forest (–AA), *Keet 513* (PRE, STE); Keurboomstrand, between hotel and Matjes River (–AB), *Botha 2241* (PRE); Storms River Mouth (–BB), *Rycroft 3006* (NBG, STE).

—**3424** (Humansdorp): Tsitzikamma, Groot River (–AA), *Fourcade 650* (BOL, GRA); Sand Dunes, Slang River (–BA), *Fourcade 2180* (BOL, STE); Seekoeirivier, road between Chattan and Paradys strand (BB), *Van der Merwe 20* (PRE).

—**3425**(Skoenmakerskop): Cape Recife (–BA), *Olivier 2277* (GRA); Skoenmakers Kop (–BA), *Paterson 495* (PRE); Emerald Hill (–BA), *Paterson 998* (BM, J, Z); Sardinia Bay, Beacon P.E.C.R. 2 (–BA), *Olivier 1789* (GRA).

1b. ***Cassine peragua* L. subsp. *barbara* (L.) R.H. Archer**, comb. nov. Type: Western Cape, Rhenosterkop, *Schlechter 10574* (PRE!, *type cons. prop.*, Archer & Van Wyk: 435 (1995); BM!, GRA!, K!, MEL!, MO!, P!, S!, Z!).

Cassine barbara L. Mantissa: 220 (1771), *type cons. prop.*, Archer & Van Wyk: 435 (1995); Thunb.: 269 (1823); Sond.: 466 (1860); Adamson: 567 (1950); Palmer & Pitman: 1317 (1973); Von Breitenbach: 115 (1987).

Cassine capensis L.: 220 (1770) *pro parte*; Davison: 332 (1927).

Slender shrub, often rhizomatous, evergreen up to 2 m high; bark without or with hardly discernible yellow pigment. *Leaves* with lamina circular, broadly elliptic to broadly obovate, green above, greyish green below, (20–) 25–40 (–50) x (15–) 20–30 (–40) mm, base rounded, rarely attenuate, apex rounded to retuse, margin glandular-crenate, crenations usually 6–10 on each side, very stiff and coriaceous; venation conspicuous in fresh and dried material; petiole 1–2 mm long. *Inflorescences* irregularly dichasial, 5–10 flowered, peduncle 10–15 mm long. *Flowers* bisexual, 4- (or 5-) merous, ± 4 mm diam.; pedicels 2–3 mm long. *Sepals* deltoid to ovate, 1 x 1 mm. *Petals* ± 2.5 x 2 mm. *Stamens* ± spreading; filaments ± 1.3 mm long, anthers ± 0.3 mm long. *Ovary* 2- or 3-locular; styles ± 0.2 mm long; stigma conspicuously 2- or 3- lobed. *Fruit* brown, spheroid, 5–10 mm diam. *Seeds* 1 or 2 per locule (Figure 2).

Cassine peragua subsp. *barbara* is easily distinguishable from the typical subspecies by its more slender habit and stiff leathery leaves as well as its widely elliptic to circular lamina. In the Cape Peninsula some geographical overlap exists between the two subspecies. This subspecies is nevertheless recognizable on sight as it is nearly always a stunted shrub, less than two metres high, confined to the coastal vegetation of the Western Cape between the Cape Peninsula and Bredasdorp district (Figure 7). Flowers mostly in March and April with fruit produced a few months afterwards.

The holotype of *C. barbara* (LINN 380.4) which is linked with the citation of Schreber in the protologue in Linnaeus (1771), belongs to *Cassine tetragona* (L.f.) Druce, a species which is to be transferred to the genus *Lauridia* (Archer & Van Wyk in prep.). Archer & Van Wyk (1995) proposed conservation of *Cassine barbara* L. with a new type.

Selected specimens examined

—**3318** (Cape Town): Kalkklipfontein (–AA), *Thompson 3600* (K, PRE, STE); Camps Bay (–CD), *Maud* (BM).

—**3418** (Simonstown): Hout Bay, Blackburn Kloof (–AB), *Marais 607* (K, P, PRE); Cape Maclear (–AD), *Adamson 907* (PRE); Gordon's Bay (–BB), *Bolus 9817* (BOL, MO, PRE); Betty's Bay (–BD), *Levyns 10649* (BOL); Hangklip, Rooiels (–BD), *Parsons 51* (K, PRE, STE).

—**3419** (Caledon): Hermanus, location (–AC), *Grobler 1056* (K, PRE); Hermanus, Mossel River (–AD), *Williams 171* (MO); Danger Point, near light house (–CB), *Pole-Evans 4338* (C, K, PRE); Koks River NW of Buffeljagt Mountain (–DA), *Thompson 3808* (PRE, STE); Soetanysberg, NE side (–DB), *Fellingham 359* (PRE); Rhenosterkop (–DD), *Schlechter 10574* (BM, GRA, K, MEL, MO, P, PRE, S, Z).

—**3420** (Bredasdorp): Windhoek, De Hoop Nature Reserve, Sandkraal se kloof (–AD), *Hugo 890* (K, MO, PRE); Lekkerwater, gulley W of Anvil Rock (–BC), *Taylor 9910* (PRE, STE); Arniston, 5 m. from Arniston (–CA), *Marsh 1451* (K, PRE, STE).

1c. ***Cassine peragua*** L. subsp. ***affinis*** (Sond.) R.H. Archer, *comb. nov.* Type: Mountains near Brackfontein and Olifants River, Clanwilliam, April, *Ecklon & Zeyher s.n.* (S!, holo.; B!, C!, K!, MEL!, MO!, SAM!, TCD!, UPS!, Z!).

Cassine affinis Sond., Flora Capensis 1: 465 (1860).

Slender evergreen shrub or small tree up to 5 m high, often multi-stemmed; bark with yellow pigment not observed. *Leaves* with lamina elliptic to obovate, dark green above, pale green below, (30–) 45–60 (–80) x (10–) 14–20 (–28) mm, base narrowly cuneate, apex caudate to rounded, margin crenate-denticulate, crenations usually 5–8 on each side, subcoriaceous; venation in fresh material fairly inconspicuous, in dried leaves conspicuous (including reticulation); petiole 6–12 mm long. *Inflorescences* lax, irregularly dichasial, 5–25-flowered, peduncle 5–15 mm long. *Flowers* bisexual, 5-merous, ± 5 mm diam.; pedicels 3–4 mm long. *Sepals* deltoid, 0.8 x 0.8 mm. *Petals* ± 3 x 2 mm. *Stamens* ± spreading; filaments ± 1.5 mm long, anthers ± 0.5 mm long. *Ovary* 3-locular; astylous; stigma inconspicuously lobed. *Fruit* light brown, spheroid to obovoid, 10–15 mm diam. *Seed* single (Figure 3).

Cassine peragua subsp. *affinis* is a distinctive taxon but has often been confused with *C. schinoides*, which is similar in general appearance and in the narrowly elliptic to obovate leaves. Its distribution range also mostly overlaps with that of *C. schinoides*. The reticulate venation of *C. peragua* subsp. *affinis*, although less conspicuous in fresh leaves, is highly conspicuous on herbarium sheets. Fruit of the two taxa are clearly different, the pericarp in *C. schinoides* being leathery and brittle, while in *C. peragua* subsp. *affinis* the pericarp is thick and fleshy. Flowering mostly in April and fruiting mostly in July and August.

C. peragua subsp. *affinis* differs from the typical subspecies in the shape of the leaves, less conspicuous (in fresh leaves) venation, larger fruit, constantly 5-merous flowers and 3-locular ovaries, while the typical subspecies usually has 4-merous flowers, but occasionally the combination of both 5-merous and 3-locular flowers occurs. The number of locules was employed by Sonder (1860) to separate this taxon from the other species of *Cassine*, although this distinction becomes less clear with additional specimens studied. The inflorescences of *C. peragua* subsp. *affinis* are often larger and more conspicuous than in the other subspecies.

This subspecies is geographically well separated from the typical subspecies, being confined to the Bokkeveld Mountains S of Nieuwoudtville, the Gifberge S of Van Rhynsdorp and the western side of the Kouebokkeveld Escarpment. An additional locality at Elandsbay may represent dispersal by means of the Verlorevlei River from the Olifantsrivier Mountains east of Elandsbay (Figure 8). Its typical habitat is usually not rocky outcrops as for *C. schinoides,* but moister situations between boulders at the base of cliffs and steep slopes or river beds.

A photograph of the subspecies is included as *Hartogia schinoides* from Pakhuis Pass [Leipoldt's grave], in Palmer & Pitman: 1326 (1973).

A large number of specimens were distributed by Ecklon & Zeyher under the name *Cassine colpoon*. The specimen in S has the original label in Zeyher's hand, and a short diagnosis, illustration and determination in Sonder's hand.

Selected specimens examined

—**3118** (Vanrhynsdorp): Gifberg, half way up (–DB), *Barker 10217* (MO, NBG, STE); Matzikammaberg, SE end between Waterval and Vaalsyfer (–DD), *Oliver 4956* (K, PRE, STE).

—**3119** (Calvinia): Rietvleikloof, SW Niewoudtville (–AC), *van der Merwe 264* (PRE, STE); Lokenburg, 21 m. S of Niewoudtville (–CA), *Story 4273* (BOL, GRA, K, PRE); Kobee mountains, Farm Kikforsfontein 364 (–CC), *Rourke 1973* (NBG, PRE).

—**3218** (Clanwilliam): Grootedrift, SE of Velorevlei (–AD), *Boucher 3603* (PRE, STE); Leipoldt's grave on Pakhuis Pass (–BB), *Taylor 8461* (PRE, STE); Olifantsrivier and Villa Brakfontein (–BD), *Ecklon & Zeyher* (B, C, K, MEL, MO, S, SAM, TCD, UPS, Z); Kapitein's Kloof (–DA), *Acocks 8613* (PRE).

—**3219** (Wuppertal): Farm Boontjieskloof byond Pakhuis Pass (–AA), *Taylor 9305* (K, PRE, STE); Niewoudt's Pass, c. 3 km before crest (–AC), *Taylor 9294* (PRE, STE); Noordhoeks River, Perdekop, S of Citrusdal (–CA), *Van Jaarsveld & Duncan 5732* (NBG); Tarakamma, lower W slope of Voorsteberg (–CC), *Van Jaarsveld 6364* (NBG).

2. ***Cassine parvifolia*** Sond. in Harv. & Sond., Flora Capensis 1: 466 (1860); Davison: 331 (1927); Von Breitenbach: 230 (1974); Coates Palgrave: 512 (1977) Bond & Goldblatt: 223 (1984). Type: Cape, Witsenberg, *Zeyher s.n.* (S!, holo., description in Sonder's hand; SAM!, TCD!).

Cassine burchellii Loes.: 193 (1894); Loes.: 223 (1897). Type: South Africa [Krakadakow Station], *Burchell 5769* (K!, lecto, here designated; GRA!, P!).

Maurocenia schinziana Loes.: 194 (1894). *Cassine schinziana* (Loes.) Loes.: 223 (1897); L. Bolus & F. Bolus: 182 (1915). Type: Houtsbay [Schlechter did not keep a register for his early numbers, more probably Mostertsberg (Mosterthoek), which Schlechter visited on 13/1/1892], *Schlechter 960* (Z!, holo.).

Icones: Von Breitenbach: 230 (1974).

Small shrub to slender tree, up to 4 m high; bark greyish, smooth or minutely cracked, yellow pigment hardly discernible or absent. *Branchlets* weakly 4-lined or terete, greyish-brown. *Leaves* opposite or occasionally subopposite; lamina narrowly elliptic to elliptic, dark green and shiny, (15–) 30–45 (–55) x (5–) 10–15 (–25) mm, base attenuate, apex acute, rounded or retuse, margin entire, revolute, coriaceous; venation with only principal lateral veins raised below in dried material, reticulation inconspicuous in dried and fresh material; petiole 2–4 mm long. *Inflorescences* sessile or nearly sessile, irregularly compact, dichasial, axillary, 1–8 -flowered, bracts minute. *Flowers* bisexual, 5-merous, ± 2 mm diam.; pedicels 2–3 mm long. *Sepals* red, deltoid to subcircular, ± 1 mm long, 1 mm wide, margin laciniate. *Petals* white, oblong, 2.2 mm long, 1 mm wide, sessile, apex rounded, margin entire, erect. *Stamens* ± erect; filaments ± 0.5 mm long, arising from margin of disc, anthers 0.4 mm long, dorsifixed, extrorse. *Disc* entire, ± flat. *Ovary* 2-locular; astylous, stigma inconspicuously lobed. *Fruit* brown to purplish, spheroid, 7–10 mm diam., mesocarp fleshy. *Seeds* 1 or 2 per locule, seed-coat brown, spheroid, embryo with cotyledons fleshy, widely elliptic (Figure 4).

Cassine parvifolia is an attractive, relatively rare and little-known suffrutex, shrub or small tree, occurring in two geographically isolated regions (Figure 9). In the mountains between Worcester and Porterville it is more frequently exposed to fire and usually grows as a suffrutex. In the fynbos and forest margin of the southern Cape at George and Knysna it mostly occurs as a shrub or small tree. Flowering is mostly in September and October. Ripe fruit is rarely collected. Vernacular name: 'Mountain Saffron' (Von Breitenbach 1987).

C. parvifolia is evidently more closely related to *C. schinoides* than to *C. peragua*, due to their similar, inconspicuous leaf venation. Nevertheless, the leaves of *C. parvifolia* are revolute, and more coriaceous than those of *C. schinoides*.

Selected specimens examined

—**3219** (Wuppertal): Porterville mountains, summit of ridge above Kromboskloof (–CC), *Oliver 3947* (PRE, STE).

—**3319** (Worcester): Kliphuisvlakte, Porterville Mountain, 'Turret Tower' hills (–AA), *Taylor 8604* (K, PRE, STE); Mountains 7 m. W of Gydouw Pass (–AB), *Hutchinson 1025* (BM, BOL, K); Witsenberg (–AC), *Bolus 5478* (BOL, PRE); Gorge W of Ceres (–AD), *Hutchinson 611* (BM, BOL, K, LISC, PRE); Worcester, Slanghoek Mountains, Cossacks (–CA), *Esterhuysen 24010* (BOL, K, PRE).

—**3322** (Oudtshoorn): Geelhoutboomberg, E, 'Tolberg' (–CD), *Taylor 4459* (PRE, STE); George, Swart River Gorge, coastal forest (–DC), *Acocks 21237* (BOL, K, PRE).

—**3323** (Willowmore): Deepwalls Forest, edge (–CC), *Keet STE 14020* (STE); Stormsriver, Tsitzikama (–DD), *Galpin 3883* (GRA, PRE).

—**3422** (Mossel Bay): Victoria Bay, hillside (–BA), *Compton 15785* (NBG).

—**3424** (Humansdorp): Witte Els Bosch (–AA), *Fourcade 2412* (BOL, K, PRE, STE); Clarkson (–AB), *Thode A774* (PRE).

3. ***Cassine schinoides*** (Spreng.) R.H. Archer, ***comb. nov.*** Type: Grootvadersbosch and Riviersonderend, *Thunberg* (UPS!, holo.).

Elaeodendron schinoides Spreng., Syst. 1: 780 (1824). *Schrebera schinoides* Thunb.: 28 (1794); 142 (1823) *nom. illeg.*, *non* L.: 1662 (1762). *Hartogia schinoides* C.A. Smith: 50 (1951); Palmer & Pitman: 1325 (1973); Von Breitenbach: 231 (1974); Coates Palgrave: 515 (1977). *Hartogiella schinoides* (Spreng.) Codd: 219 (1983); Bond & Goldblatt: 224 (1984).

Hartogia capensis L.: 288 (1762); L. f.: 128 (1782), *non* L.: 939, 1365 (1759); Thunb.: 87, t. *s.n.* (1784); Sim: 182 (1907); Fourcade: 84 (1934) . Type: as for *C. schinoides* (Spreng.) R.H. Archer.

H. riparia Eckl. & Zeyh.: 127 (1834/5). *H. capensis* L. var. *riparia* (Eckl. & Zeyh.) Sond.: 464 (1960). Type: 'Bergrivier prope sinum Saldanhabay', December, *Ecklon & Zeyher* (S!, lecto., here designated, C!, SAM!, Z!).

H. multiflora Eckl. & Zeyh.: 127 (1834–35). *H. capensis* L. var. *multiflora* (Eckl. & Zeyh.) Sond.: 464 (1860). Type: 'Tulbaghsberge supra Waterfall (Worcester). Dec. Jan.', *Ecklon & Zeyher* (S!, lecto., here designated, label in Pappe's hand?, C!, P!, PRE!, SAM!, UPS!).

Hartogia capensis L. var. *latifolia* Sond.: 464 (1860). Type: as for *H. riparia*.

Hartogia capensis L. var. *lanceolata* Sond.: 464 (1860); Szyszl.: 32 (1888). Types: as for *H. capensis* L.

H. angustifolia Turcz. 36: 601 (1863). Type: Cape [Pikaniers Kloof, Kardouw, Olifants & Twenty Four Rivers], *Zeyher 307* (KW, holo?, BM!, K!, PRE!, Z!).

Icones: Davison t.12 (1927).

Slender tree up to 5 m high; bark greyish, often with layers of powdery yellow pigment in the exposed rhytidome which exfoliates as scales, surface fairly smooth or minutely cracked into longitudinal lines. *Branchlets* weakly 4-lined or terete, greyish brown. *Leaves* opposite; lamina narrowly elliptic to elliptic, obovate to oblanceolate, pale green above, grey-green below, (15–) 30–55 (–70) x (5–) 8–20 (–35) mm, base narrowly cuneate, apex rounded, margin glandular-crenate, crenations usually 6–10 on each side, coriaceous; venation inconspicuous, with only principal lateral veins raised below on dried material; petiole 4–7 mm long. *Inflorescences* pedunculate, irregularly dichasial, axillary, 5–10 flowered, peduncle 5–10 mm long, bracts minute. *Flowers* bisexual, 4-merous, ± 3 mm diam.; pedicels 2 mm long. *Sepals* greenish, deltoid, 0.8 mm long, 0.8 mm wide, margin ciliolate. *Petals* white or cream, elliptic to oblong, ± 2.6 mm long, ± 1.7 mm wide, sessile, apex rounded, margin entire, ± spreading or erect. *Stamens* ± erect; filaments ± 0.5 mm long, arising from sinuses in the disc, anthers 0.5 mm long, basifixed, introrse. *Disc* fleshy, subentire with prominent sinuses. *Ovary* 2-locular; astylous; stigma inconspicuously lobed. *Fruit* brown, spheroid to ellipsoid, 5–11 mm diam., mesocarp crustaceous. *Seeds* 1 or 2 per fruit, seed-coat brown, spheroid to ellipsoid; embryo with cotyledons fleshy, widely elliptic to circular (Figure 5).

Cassine schinoides is a shrub or small tree. It is fairly abundant in the western parts of the Western Cape, where it occurs in fynbos, woodlands as well as in forests, but is rare in the southern Cape forests where it is occasionally found in dry woodland and on forest margins (Figure 10). Flowering in mostly November and December. Fruiting period long, up to six months. Common names recorded are ‘Spoonwood’, ‘Ladlewood’ (Von Breitenbach 1987).

In contrast with the other species of *Cassine*, the pericarp in *C. schinoides* contains clusters of sclereids, thus giving a hard and brittle appearance to the fruit.

Leaves of *C. schinoides* were chewed as a thirst quencher (Watt & Breyer-Brandwijk 1962). The wood has been useful in cabinet-making (as veneer), furniture and wagon making (Sim 1907; Watt & Breyer-Brandwijk 1962).

Hartogia capensis L. and *Schrebera schinoides* Thunb. are later homonyms of *H. capensis* L. (Rutaceae) and *S. schinoides* L. (Convolvulaceae) respectively, and are therefore illegitimate (Smith 1951; Codd 1983). K. Sprengel (1824) had taken up Thunberg's illegitimate epithet as *Elaeodendron schinoides* (but without effecting a new combination; Art 58.3: Greuter *et al.* 1994) and this is therefore the earliest available epithet for the species. Codd (1983) created a new genus to accommodate *Hartogia schinoides* despite expressing doubts (Codd 1966) as to the generic status of this monotypic genus. He retained the genus on account of its alleged lack of endosperm in the seed. Endlicher (1840), Sonder (1860), Loesener (1942a), Bentham & Hooker (1862) & Davison (1927) all advanced the alleged exendospermous seed of the genus as a reason for its separation. This error was first made by Endlicher (1840), and indiscriminately copied by these subsequent workers (Fourcade 1934), who correctly noted that seeds of the species studied by him is endospermous. However, *Hartogiella* is loosely circumscribed and as a genus is difficult to distinguish from *Cassine*. Except for the presence of starch in endosperm and cotyledons, and the occasional presence of clusters of raphides of magnesium oxalate in the leaf epidermis (Archer 1990), no constant anatomical or morphological supraspecific differences could be found between *Hartogiella* and the species of *Cassine*. Maintaining *Hartogiella* as a separate genus has become untenable, hence its inclusion under *Cassine.*

Hartogia was described with about three species (Loesener 1942a, Codd 1983), namely *H. schinoides*, *H. trilobocarpa*, a species from Madagascar (now in *Hartogiopsis* H. Perrier de la Bâthie, with dehiscent fruit) and one from East Africa, namely *H. agrifolium* Chiov. The latter is to be treated as *Elaeodendron aquifolium* (Fiori) Chiov.

Selected specimens examined

—**3218** (Clanwilliam): Cederberg, Pakhuis Pass, on by-road past Soldaatkop (–BB), *Taylor 10990* (PRE); Elands Kloof Pass (–BD), *Compton 22692* (NBG); Piquetberg, Kapitein's Kloof (–DA), *Acocks 8612* (PRE); Pikenierskloof, Kardouw, and at the source of the Olifants and Twenty Four Rivers (–DB), *Zeyher 307* (PRE, Z).

—**3219** (Wuppertal): Boontjieskloof NE of Pakhuis (–AA), *Esterhuysen s.n.* (BOL); Cederberg Staatsbos, Middelbergvlaktes (–AC), *Andrag 49* (PRE); Ceres, Donkerkloof (–CC), *Hanekom 2060* (K, MO, PRE); Ceres, Waboomsrivier (–CD), *Hanekom 731* (PRE, K).

—**3318** (Cape Town): Kirstenbosch, bottom of Skeleton Gorge (–CD), *Marais 622* (GRA, P, PRE); Paarlberg (–DB), *Drege PRE-24631* (PRE, S); Jonkershoek (–DD), *Parker 4536* (BOL, K, NBG, UPS).

—**3319** (Worcester): Porterville, Twenty Four River Kloof (–AA), *Van Wyk, Retief & Herman 6734* (PRE, PRU); Witzenberg (–AC), *Pillans 9637* (BOL, PRE); Witelskloof off Mitchell's Pass (–AD), *Esterhuysen 14945* (BOL, PRE, UPS); Grasruggens Mountain (–BA), *Pillans 8714* (BOL, PRE); Du Toit's kloof (–CA), *Drège* (K, P, PRE, S); Onse Rug Farm, at foot of Fonteinjiesberg (–CB), *Goldblatt 4087* (PRE); French Hoek Pass summit, manganese outcrop (–CC), *Boucher 2279* (K, PRE, S, STE).

—**3320** (Montagu): Swellendam, Langeberge (–CD), *Schlechter 2054* (BOL, C, K, PRE); Tradouw Pass, between Barrydale and Swellendam (–DC), *Goldblatt 1701* (K, PRE); Grootvadersbosch (–DD), *Taylor 736* (PRE).

—**3323** (Willowmore): Diepwalle, Dirk-se-eiland (–CC), *Geldenhuys 353* (PRE); Lottering, Olifantsvlakte (–CD), *Geldenhuys 281* (PRE); Storms River Pass (–DD), *Story 3557* (PRE).

—**3324** (Steytlerville): Witelsbos Forest Station, forest opposite Witels Kop (–CC), *Archer 563* (PRE); Karedouw Pass (–CD), *Fourcade 3243* (BOL, K).

—**3418** (Simonstown): Tokai Forest Reserve, Kloof below Simon's dam (–AB), *Marais 626* (BM, GRA, PRE); Steenbras, (–BB), *Rogers 1510* (Z); Disakloof, Betty's Bay (–BD), *Rourke 693* (NBG).

—**3419** (Caledon): Lebanon Catchment Ig (–AA), *Kruger 414* (K, PRE, STE); Zwartberg (–AB), *Schlechter 9771* (BM, BOL, K, MO, P, PRE, S, Z); Kogelberg Reserve, Paardeberg (–AC), *Grobler 24241* (PRE); Small kloof E of Vogelgat, Hermanus (–AD), *Williams 1947* (NBG, STE).

—**3420** (Bredasdorp): Grootvadersbosch (–AB), *Burchell 7225* (GRA, K, P, S).

—**3421** (Riversdale): Riversdale, Corente River Farm (–AA), *Muir sub Galpin 5067* (PRE).

—**3424** (Humansdorp): Clarkson (–AB), *Thode A773* (K, PRE).

Species excluded

[The present list does not included numerous names of *Cassine* now under *Elaeodendron*.]

Cassine micrantha Hayata (1913) = *Otherodendron micrantha* (Hayata) Loes.: 130 (1942).

Cassine micrantha (Tul.) Loes.: 76 (1942) = *Elaeodendron micranthum* Tul. (from Madagascar).

Cassine mucronata Turz.: 31: 455 (1858). = *Cassinopsis ilicifolia* (Hochst.) Kunth.

Table 3. Summary of differences between the members of *Cassine* L.

	C. peragua* subsp. *barbara	***C. peragua* subsp. *peragua***	***C. peragua* subsp. *affinis***	***C. schinoides***	***C. parvifolia***
Geographical distribution	coast between Cape Peninsula and Bredasdorp	infrequently in Northern Province, Mpumalanga and Swaziland, frequent KwaZulu-Natal, Eastern & Western Cape	confined to the Bokkeveldberge S of Nieuwoudtville and Gifberg	widespread Western Cape	mountains between Worcester and Porterville; relatively rare in George and Knysna
Habitat	coastal scrub	forest and forest margins and woodland	riverine fringes or moist vegetation next to rocky outcrops	fynbos or usually forest and forest margins or woodland	fynbos; forest margins
Habit	stunted multistemmed shrub up to 2 m high	tree up to 15 m high	small, multistemmed tree	small to medium sized tree	suffrutex, shrub, or small tree
Bark Yellow pigment in exposed rhytidome	hardly discernible or absent	conspicuous	absent	often present	present on root bark only
Leaves Shape	broadly elliptic or circular	usually elliptic to obovate	narrowly elliptic, elliptic to obovate	narrowly elliptic to elliptic, obovate to oblanceolate	narrowly elliptic to elliptic
Apex	rounded to retuse		caudate to rounded	rounded	acute, rounded or retuse
Venation	conspicuous (translucent)		conspicuous (less so in fresh material)	inconspicuous	
Margin	glandular-crenate				entire, revolute
Petiole lenght	1–2 mm	4–8 mm	6–12 mm	4–7 mm	2–4 mm
Inflorescences	usually shortly pedunculate	pedunculate			sessile or nearly sessile
Flowers (excl. ovary)	4- or 5-merous		5-merous	4-merous	5-merous
Ovary	2- or 3-locular		3-locular	2-locular	
Fruit	brown	brown to purplish	light brown	brown	brown to purplish
Shape	spheroid			ellipsoid	spheroid
Pericarp	fleshy			crustaceous and brittle	pericarp fleshy

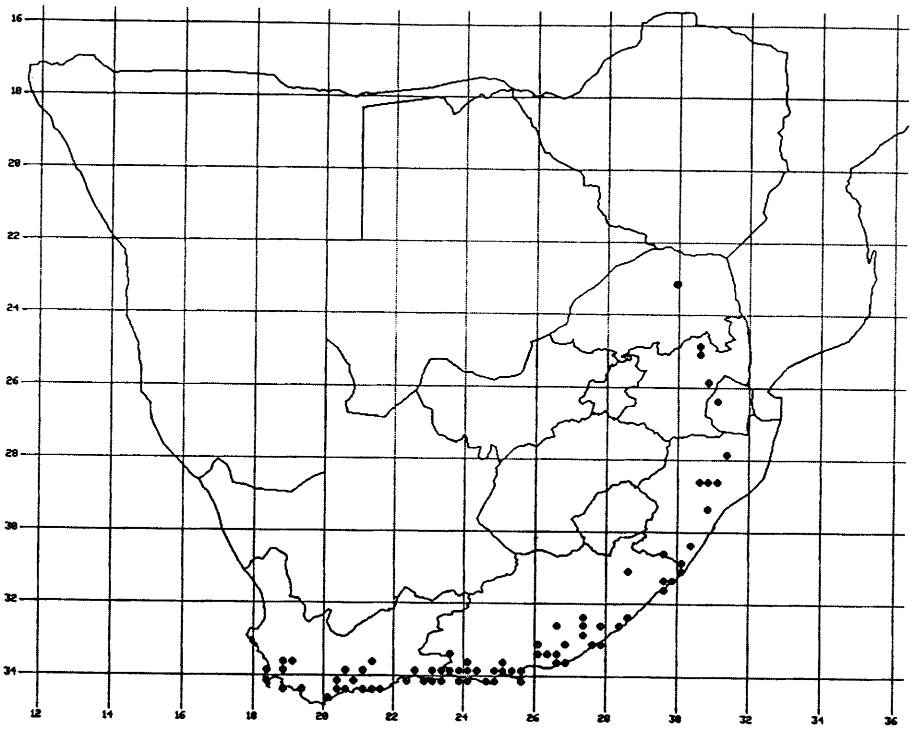
Figure 1. *Cassine peragua* subsp. *peragua*. Portion of flowering branch. *Krynouw 33* (PRE).

Figure 2. *Cassine peragua* subsp. *barbara.* Portion of flowering branch. *Schlechter 10574* (PRE).

Figure 3. *Cassine peragua* subsp. *affinis*. Fruiting branch. *Taylor 10995* (PRE).

Figure 4. *Cassine parvifolia.* Fruiting branch. *Morze 2059* (PRE).

Figure 5. *Cassine schinoides*. Fruiting branch. *Bayliss BRI B 6280* (PRE).



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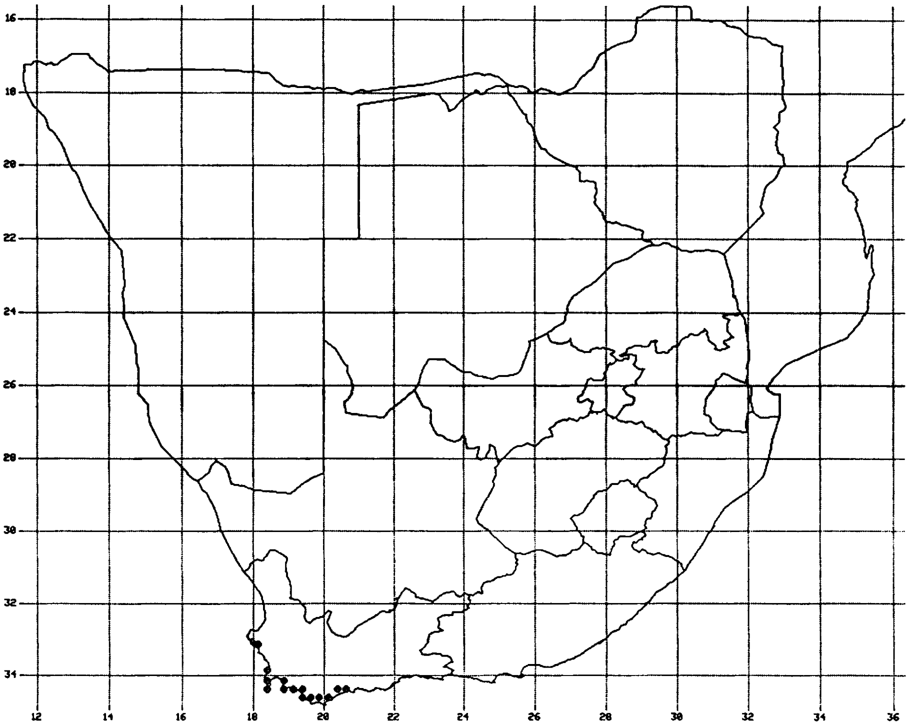

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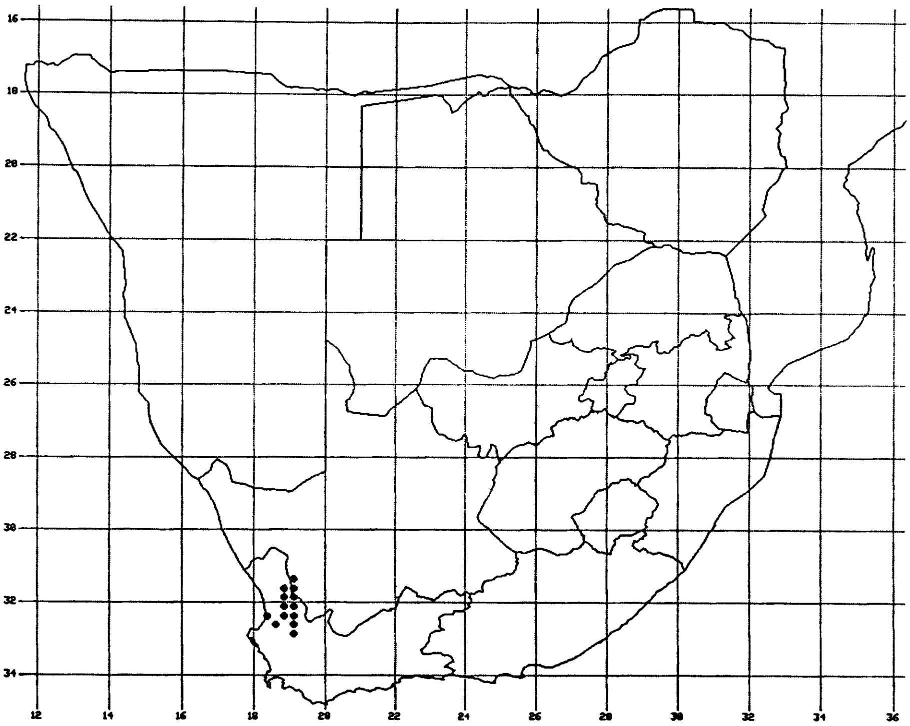
Figures 6 & 7. Known distribution of *Cassine* spp. **6.** *Cassine peragua* subsp. *peragua*. **7.** *Cassine peragua* subsp. *barbara*.



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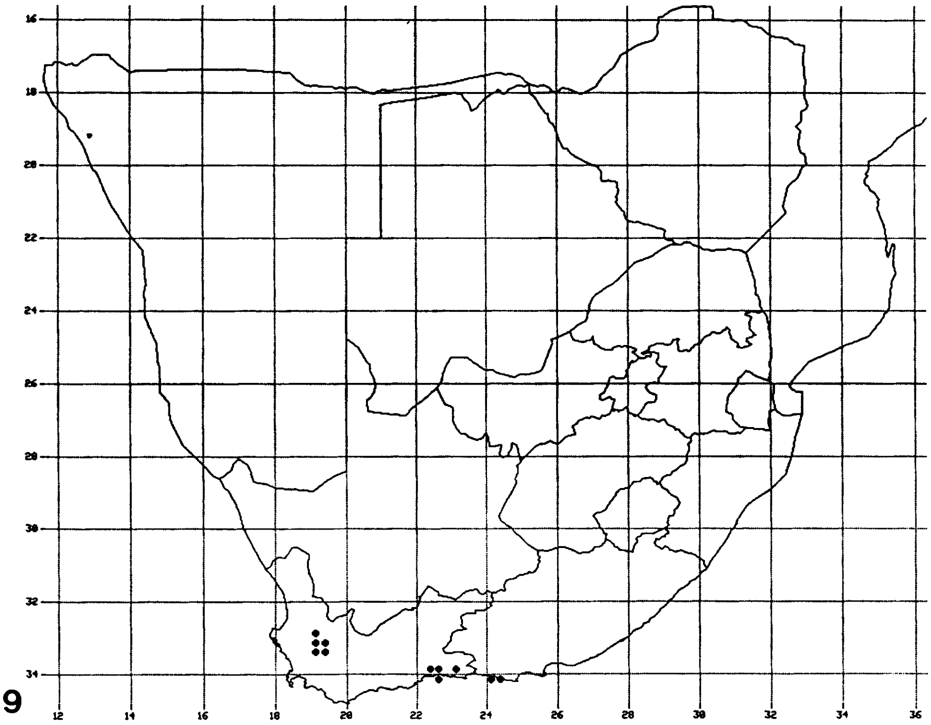

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Figures 8 & 9. Known distribution of *Cassine* spp. **8.** *Cassine peragua* subsp. *affinis*. **9.** *Cassine parvifolia*.

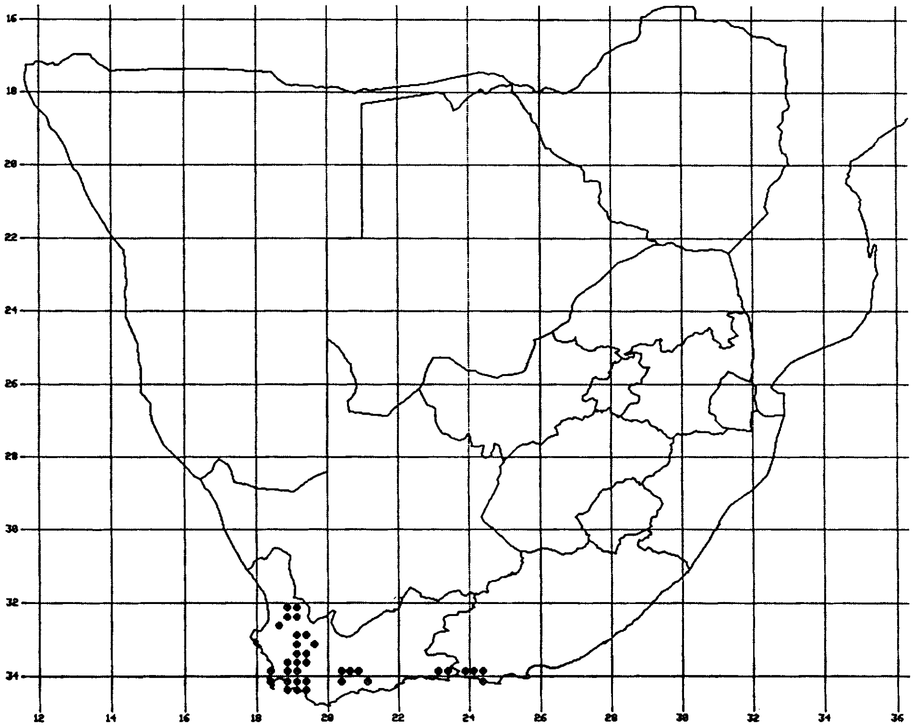

Figure 10. Known distribution of *Cassine schinoides.*

5.2 *LAURIDIA* ECKL. & ZEYH.*

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A taxonomic revision of *Lauridia* Eckl. & Zeyh. (Celastraceae)

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Evidence from macromorphology, anatomy and palynology, suggests the subdivision of the large and heterogeneous *Cassine* L. *s.l.*, into smaller, more homogeneous genera. *Lauridia* Eckl. & Zeyh., as delimited here, includes two species of small trees or lianas endemic to southern Africa. Hitherto the genus has either been considered as monotypic, based on *Lauridia reticulata* Eckl. & Zeyh., or it has been included in a widely circumscribed *Cassine*. *Cassine tetragona* (L.f.) Druce is transferred to *Lauridia* and the new combination *L. tetragona* is proposed.

Introduction

Available evidence supports arguments for subdividing the heterogeneous *Cassine* L. *s.l.* into a number of more homogeneous segregate genera (Archer 1990; Archer & Van Wyk 1992, 1993a, 1993b). The hitherto monotypic genus *Lauridia* Eckl. & Zeyh., based on *L. reticulata* Eckl. & Zeyh., is reinstated here, though its circumscription is enlarged so as to include *Cassine tetragona*. Both species are endemic to southern Africa.

Lauridia reticulata is a rare and little known species often confused with other Cassinoideae. It has largely been overlooked in publications on southern African trees, and should, for example, be taken up in the *National List of Indigenous Trees* (Von Breitenbach 1987). Although *L. tetragona* (=*Cassine tetragona*) is currently included in this list, it is a liana, and in the authors's opinion never reaches tree size.

In recent years, *L. tetragona* has been included in either *Allocassine* N. Robson or *Cassine s.l.* However, data from various sources supports a close affinity with *Lauridia reticulata* rather than with any other groups. Diagnostic characters distinguishing *Lauridia* from *Cassine s. str.* and the closely related genera *Allocassine* and *Maurocenia*, are presented in Table 4. Fruit in all these genera are berries in contrast to the rest of the southern African Cassinoideae which have drupes.

Inflorescence structure in *Lauridia* is quite different from that of all other African Cassinoideae. Davison (1927) already regarded *Lauridia* as distinct due to its 'unique racemose' inflorescences. The inflorescences are actually thyrsoid with 5–15 cymules on a straight indeterminate axis. Basal cymules are often pedunculate, whereas the apical ones are sessile. In *L. tetragona* the axis of the inflorescence is usually determinate, resulting in a dichasial branching pattern. However, occasionally the main axis continues growing and produce lateral cymules, a pattern resembling the state in *L. reticulata*. The thyrsoid inflorescences and sessile flowers are among the main morphological characters shared by the two species. Other characters shared by *L. reticulata* and *L. tetragona* include the same pollen type, flower and fruit morphology, and wood and bark structure (Archer 1990; Archer & Van Wyk 1992, 1993a, 1993b).

Allocassine and *Maurocenia* are in many ways similar to *Lauridia* (Table 4). *Allocassine* can be readily distinguished from all other southern African Cassinoideae by its large, elongated fruit and seed. The presence of pendulous ovules in *Maurocenia* sets it apart from *Lauridia,* which has erect ovules.

Taxonomic history

Lauridia was described by Ecklon & Zeyher (1834/5) with two species, *L. reticulata* and *L. rupicola* (*nom. nud.*). *Lauridia* was maintained as a monotypic genus by Sonder (1860) and by Bentham (1862). Davison (1927), while combining several genera under *Cassine s.l.*, kept *Lauridia* separate, mainly because of its unusual inflorescence structure. Robson (1965) treated *L. reticulata* as a species of *Elaeodendron* and considered it closely related to *E. schlechteriana* (Loes.) Loes. Codd (1966) largely rejected Robson's classification of the southern African Cassinoideae, and transferred *L. reticulata* to *Cassine s.l.*

Robson (1965) described a new genus, *Allocassine,* with two species, *A. laurifolia* and *A. tetragona*. Codd (1966) accepted the former, but retained the latter as a species of *Cassine,* namely *Cassine tetragona* (L.f.) Druce (author citation incorrectly cited as '(L.f.) Loes.').

Taxonomy

Lauridia Eckl. & Zeyh., Enumeratio Plantarum Africae Australis Extratropicae 1: 124 (1834/5); Harvey: 58 (1838); Sonder: 468 (1860); Bentham: 363 (1862); Davison: 338 (1927).

Small evergreen tree, scrambling shrub or liana; unarmed, glabrous, without elastic threads (*trans*-1–4-polyisoprene) in bark and leaves; bark with yellow pigment usually present or hardly discernible. *Branchlets* 4-lined to subangular. Leaves opposite; stipules minute, ± 1 mm long, triangular, brownish-black, marcescent. *Inflorescences* sessile or pedunculate, axillary, compact thyrsoid with cymules along straight central axis, or irregularly dichasial. *Flowers* bisexual, 4(5)-merous, sessile. *Sepals* equal, widely ovate. *Petals* cream to white, widely elliptic to ovate; margin entire. *Stamens* ± erect, arising from the margin of disc with which they are united at the base; anthers introrse, dehiscing by longitudinal slits. *Disc* fleshy, entire. Ovary ± ⅓ immersed in and adnate to the disc, 2-locular, with two erect, collateral ovules per locule; ovules hypotropous, ventral; style very short or absent; stigma usually conspicuously lobed. *Fruit* baccate, red to purple or purplish-black, spheroid, 5–10 mm diam.; mesocarp fleshy. *Seeds* one or two per fruit, spheroid; seed-coat brown, post-chalazal vascular bundles not observed; endosperm present, fleshy; embryo erect, with cotyledons fleshy, widely elliptic to widely ovate.

Key to the species

1a. Shrub to small tree; leaf margin usually entire; inflorescence sessile, compact thyrsoid with cymules on straight axis; flowers 4-merous; branchlets usually spreading, weakly 4-lined or terete .... *L. reticulata*

1b. Scrambling shrub or liana; leaf margin glandular-crenulate; inflorescence pedunculate, a small compound dichasium, occasionally compact thyrsoid with cymules on straight axis; flowers 4- or 5-merous; branchlets often retrorse, conspicuously 4-lined .... *L. tetragona*

1. ***Lauridia reticulata*** Eckl. & Zeyh., Enumeratio Plantarum Africae Australis Extratropicae. 1: 124 (1834/5); Davison: 339 (1927). Type: Eastern Cape Province, 'Zoutpanshoogde' near 'Zwartkopsrivier', *Ecklon & Zeyher s.n.* (S!, lecto., here designated, specimen on right hand side of sheet; MEL!).

Mystroxylon reticulatum (Eckl. & Zeyh.) Dietr.: 817 (1839). *Elaeodendron reticulatum* (Eckl. & Zeyh.) Ettingshausen: 58 (1857); N. Robson: 39 (1965). *Cassine reticulata* (Eckl. & Zeyh.) Codd: 123 (1966).

Lauridia rupicola Eckl. & Zeyh.: 124 (1834/5). *nom nud.*

Icones: Davison: t.14 (1927).

Small shrub to slender tree up to about 4.5 m high; bark greyish, surface rough and flaky, exfoliating in scales, with layers of yellow powdery pigment in the exposed rhytidome. *Branchlets* weakly 4-lined to flattened when young, becoming terete, greyish. *Leaves* opposite; lamina elliptic to broadly elliptic, both sides dark green, (15–) 25–45 (–70) x (7–) 12–25 (–25) mm, base cuneate, apex acuminate to acute, margin entire, occasionally with 1–4 indistinctly glandular-denticulations on each side, coriaceous; venation ± raised below, less prominent above in dried material, fine reticulation less conspicuous, brochidodromous; petiole 2–5 mm long. *Inflorescences* sessile, compact thyrsoid with 5–15 cymules on straight indeterminate axis, basal cymules pedunculate, apical cymules sessile; bracts minute. *Flowers* bisexual, 4-merous, ± 4 mm diam. *Sepals* greenish, widely ovate, ± 1 x 1.3 mm, coriaceous, margin irregularly ciliolate. *Petals* cream, widely elliptic, ± 2.4 x 1.5 mm, sessile, apex rounded, spreading. *Stamens* ± erect; filaments ± 0.8 mm long, flattened, arising from margin of disc, anthers ± 0.7 mm long, sub-dorsifixed. *Disc* fleshy, entire. *Ovary* 2-locular; styles 0.2 mm long; stigma inconspicuously lobed. *Fruit* sequentially changing from green through light red, purple to purplish black when ripe, ± 8 mm diam. *Seed* ± 4 mm diam.; embryo with cotyledons fleshy, widely elliptic (Figure 11).

Lauridia reticulata is a relatively rare species with a restricted geographical range in the Eastern Cape (Figure 13). Plants occur erratically in bush clumps and wooded areas between Humansdorp and Grahamstown. Although locally common at some localities, it is a rare and little known species.

L. reticulata is an attractive evergreen shrub or small tree. Flowers and fruits are produced sporadically throughout the year, usually in profusion. The ripening is asynchronous with sequential colour changes, indicative of bird dispersal.

Ripe fruits appear normal but many prove to be sterile (seedless or with abnormal or damaged seed). No seedlings were noted during field studies. This could be one of the reasons for the restricted distribution of the species. Genetically mediated reproductive failure has been suggested as a possible cause of low seed set. Susceptibility to fungal and insect damage may also play a role (Archer 1990).

Collections of Rehman (in Z), collected in Houtbay and identified by Szyzylowicz (1888) as *Lauridia reticulata,* is *Sideroxylon inerme* L. subsp. *inerme*. Adamson's (1950) and Levyn's (1966) claim that *L. reticulata* occurs in the Cape Peninsula is probably based on these misidentifications.

Selected specimens examined

—**3324** (Steytlerville): Baviaanskloof, Doringskloof (–CA), *Geldenhuys 1026* (K, PRE); Hankey, Vensterhoek (-DD), *Van Jaarsveld & Campher 9885* (NBG).
—**3325** (Port Elizabeth): Suurberg, circle route N of forestry office (–BC), *Geldenhuys 1033* (PRE); Rooiwaterkloof Catchment basin, Groendal Wilderness Reserve (–CA), *Scharf 1033* (PRE); *1537* (NBG, PRE); Longmore Forest Reserve (–CC), *Marais 387* (BOL, GRA, K, PRE); Springs Nature Reserve, on top of View, Bayview (–CD), *Olivier 2291* (GRA); Koega (–DC), *Drège TRV-18591* (BM, PRE, Z).
—**3326** (Grahamstown): Grahamstown, Slaaikraal (–AD), *Hoole PRE-58310* (GRA, PRE); 7.2 mile from Grahamstown on Fort Beaufort road (–BA), *Brink 387* (GRA, PRE); Collingham Farm, 8 km from Grahamstown on East London road (–BC), *Lubke & Wrigley 628* (GRA); Hopewell, S of Southwell (–BD), *Acocks 16149* (K, PRE).
—**3424** (Humansdorp): Humansdorp,Boskloof (–BB), *Archer 562* (BOL, PRE, PRU).

2. ***Lauridia tetragona*** (L.f.) R.H. Archer, *comb. nov*. Type: Cape of Good Hope, *Thunberg s.n.* in *herb. Thunberg 5469* (UPS!, lecto., here designated).

Rhamnus tetragonus L.f., Supplementum Plantarum: 153 (1781); Thunb.: 44 (1794); 71–72 (1818); 196 (1823). *Cassine tetragona* (L.f.) Druce: 612 (1917). *Allocassine tetragona* (L.f.) N. Robson: 32 (1965).

Celastrus tetragonus Thunb.: 42 (1794). *Cassine tetragona* (Thunb.) Loes.: 158 (1900); Davison: 331 (1927). Type: Cape of Good Hope, *Thunberg* [No original material of *Celastrus tetragonus* could be traced, although Robson (1965) mentioned seeing a photograph of the type. However, Thunberg himself did not include this taxon in later editions of his Flora Capensis, thereby perhaps admitting the fact that it is the same taxon as his *Rhamnus tetragona*].

Cassine scandens Eckl. & Zeyh.: 128 (1834/5); Sond.: 467 (1860). Type: Cape, Zwartkopsrivier, *Ecklon & Zeyher 2208* (S!, lecto., B!, PRE!, TCD!, Z!).

Cassine latifolia Eckl. & Zeyh.: 129 (1834/5); Sond.: 466 (1860); Davison: 332 (1927). Type: Cape, George, Plettenbergsbay, *Ecklon & Zeyher* (S!, holo.,C!, Z!).

Cassine albanensis Sond.: 467 (1860). Type: Eastern Cape, Albany, *Barber* [*Miss Bowker*] *s.n.* (S!, holo., MEL!, TCD!).

Cassine latifolia Eckl. & Zeyh. var. *heterophylla* E. Mey. ex Sond.: 467 (1860). Type: Rocky places on the Witberg, *Drège s.n.* (S!, holo.).

Cassine scandens Eckl. & Zeyh. var. *laxa* Loes.: 194 (1894). *Cassine tetragona* Thunb. var. *laxa* (Loes.) Loes.: 158 (1900). Type: Transvaal, *Thorncroft* sub *Wood 4956* (Z!, holo.).

Scrambling shrub or liana up to 3 m high; bark greyish with yellow pigment observed only in root bark; liane stem structure irregular in outline with deeply penetrating wedge-shaped secondary phloem inclusions in the wood. *Branchlets* conspicuously 4-lined or rarely terete when young, greenish, usually deflexed as an adaptation to climbing habit. *Leaves* opposite; lamina narrowly elliptic, elliptic to widely elliptic to oblong, or ovate, occasionally asymmetrical, bright green on both surfaces, (15–) 25–93 (–130) x (10–) 15–25 (–65) mm, base rounded to cordate, rarely cuneate, apex caudate to acute to occasionally rounded, margin glandular crenulate-denticulate, dentations 5–10 (–20) on each side, subcoriaceous; venation ± raised above and below in dried material, reticulation not prominent, indistinctly brochidodromous; petiole 2–3 (–5) mm long. *Inflorescences* pedunculate, irregularly compact dichasial, or occasionally compact thyrsoid with 6–14 cymules on a straight axis, cymules pedunculate, axillary towards apices of branchlets, 5–30-flowered; peduncle 5–10 mm long; bracts minute. *Flowers*

4–5 merous, ± 3.5 mm diam., sessile. *Sepals* greenish, widely ovate, ± 1 x 1.5 mm, coriaceous, margin ciliolate. *Petals* white, ovate, ± 2 x 1.5 mm wide, sessile, apex rounded, ± erect. *Stamens* ± erect, covered by the petals; filaments ± 0.8 mm long, arising from margin of disc; anthers ± 0.5 mm long, basifixed, versatile. *Disc* fleshy, entire. *Ovary* 2-locular; style very short or absent, conspicuously lobed. *Fruit* red to purple when ripe, 5–8 mm diam. *Seeds* 1 or 2, 3–4 mm diam., cotyledons fleshy, widely ovate (Figure 12).

Lauridia tetragona is widespread in the southern coastal vegetation in dune scrub and forest and on inland forest margins from near Hermanus in the Western Cape, along the coast to northern KwaZulu-Natal, becoming less frequent along the escarpment of KwaZulu-Natal, Swaziland, Mpumalanga and Northern Province (Figure 14).

Despite the considerable variation in habit and leaf morphology displayed by *Lauridia tetragona*, it is not possible to distinguish any infraspecific taxa. Plants from coastal regions tend to be prostrate with widely-elliptic or widely-ovate leaves, whereas those from forest margins along the escarpment possess a more definite liana habit and the leaves are larger, asymmetrical and narrowly elliptic. In higher altitude grassland of the Eastern Cape and KwaZulu-Natal plants tend to be shrubby with leathery leaves. In vegetative facies *L. tetragona* is superficially similar to *Rhoiacarpos capensis* (Harv.) A. DC. (Santalaceae), a species with which it has frequently been confused in herbaria (even a syntype of *L. tetragona*!).

The authority of *Cassine tetragona* has usually been cited incorrectly as (L.f.) Loes. (e.g. Arnold & De Wet 1993). An overlooked combination was made by Druce (1917), which referred to *Rhamnus tetragona* L.f. An earlier combination (Loesener 1900) referred to the later homonym *Celastrus tetragonus* Thunb. Loesener's (1942) correction of the author citation cannot be attributed to him because of the earlier combination by Druce.

The holotype of *Cassine barbara* L. (1771) (Schreber, LINN Herb. 380.4) is in fact a specimen of *Lauridia tetragona*. Under strict application of the principle of priority, *Cassine barbara* would but for Art. 57 of the Tokyo *Code* (Greuter *et al.* (1994), have to replace the name *C. tetragona*. To avoid a disadvantageous name change and a potential source of confusion, this name has been proposed for conservation with a new type under Art 14.9 of the Tokyo *Code* (Archer & Van Wyk 1995).

Selected specimens examined

Swaziland

—**2631** (Mbabane): Hlatikulu (–CD), *Compton 26238* (NBG, PRE).

South Africa

—**2229** (Waterpoort): Hanglip, 20 mile NE of Louis Trichardt (–DD) *Gerstner 6016* (K, PRE).

—**2230**: (Messina): Entabeni Plantation (–BD), *Hemm 646* (J).

—**2430** (Pilgrim's Rest): Mariepskop (–DB), *Keet STE 14084* (STE); Mount Sheba (–DC), *Kluge 2318* (NBG, PRE).

—**2731** (Louwsburg): 6 mile N of Black-Umfolozi on road to Stylrand on Sihluti Mt. (–CC), *Codd 1554* (K, PRE); Ngome Forest (–CD), *Gerstner 5203* (PRE).

—**2830** (Dundee): Kranskop, 0.8 km S of Olifantshoek Store (–DD), *Edwards 2839* (B, K, PRE, Z).

—**2831** (Nkandla): Eshowe (–CD), *Gerstner 2786* (K); Ngoye Forest (–DC), *Smook 1265* (K, PRE).

—**2929** (Underberg): Cathedral Peak Forestry Station, Ndedema Gorge (–AB); *Killick 2297* (PRE); Giant's Castle Game Reserve (–BA), *Moll 5486* (PRE); Garden Castle Forest Reserve, beyond forester's house (–CB); *Hilliard & Burtt 13425* (K, PRE, S).

—**2930** (Pietermaritzburg): 4.8 km W of Uitzien Post Office (–AA), *Acocks 11606* (PRE); N of KwaMabeyana (–BD), *Balkwill & Balkwill 4956* (J, PRU).

—**2931** (Stanger): Mount Edgcombe (–CA), *Wood 1101* (K).

—**3030** (Port Shepstone): Alexandria, Dumisa Station (–AD), *Rudatis 1196* (K); Port Natal, Lower Umkomaas [River] (–BB), *Gerrard & McKen 1385* (TCD); Oribi Gorge Nature Reserve, River (–CA), *Van Wyk 4186* (PRE); Umtamvuna Nature Reserve, Hazelridge Forest (–CC), *Van Wyk 6101* (PRE); Port Shepstone, Mgongongo (–CD), *Strey 7715* (K, PRE).

—**3126** (Queenstown): Rockwood, Bongola Dam (–DD), *Galpin 2586* (GRA, P, PRE).

—**3127** (Lady Frere): Indwe, Jonashoek (–AD), *Van Zinderen-Bakker 51* (PRE).

—**3129** (Port St Johns): Port St Johns, (–DA), *Bayliss BRI 1463* (K, Z).

—**3226** (Fort Beaufort): Fort Beaufort (–DC), *Bayliss 2993* (NBG).

—**3227** (Stutterheim): Keiskama Hoek (–CA), *Steiner 77* (GRA, PRE); Komga (–DB) *Flanagan 166* (PRE); Bonza Bay (–DD), *Comins 1072* (K, PRE).

—**3228** (Butterworth): Kentani (–AD), *Pegler 743* (BOL, GRA, K, PRE); Elliotdale, The Haven (–BB), *Gordon-Gray 648* (GRA); Manubi Forest (–BC), *Wells 3608* (GRA, K, PRE); Kei Mouth (–CB), *Flanagan 172* (PRE, UPS); Cintsa River mouth (–CC), *Strey 11218* (K, PRE).

—**3322**(Oudtshoorn): George, 7 mile E of George (–DB), *Marais 700* (BOL, GRA, K, PRE); Wilderness (–DC), *Marloth 12717* (PRE).

—**3325** (Port Elizabeth): Addo Elephant National Park, Zuurkop (–BD), *Botha 5855* (PRE); Longmore Forest Reserve (–CC), *Marais 722* (GRA, K, PRE); Zwartkops River, Villa Paul Maré (–CD), *Ecklon & Zeyher s.n.* (B, BOL, NBG, S, STE, TCD, Z); Port Elizabeth, St. George's strand (–DC), *Long 857* (K, PRE).

—**3326**(Grahamstown): Mitford Park Farm, 27 mile from Grahamstown near Riebeeck East (–AA), *Dyer 3320* (K, P, PRE); Shamwari Game Reserve Park, Alicedale (–AC), *Palmer 2582* (GRA); Grahamstown, 5 mile from Grahamstown on Cradock road (–AD), *Booi 50* (GRA, K, PRE); Grahamstown (–BC), *Daly & Janse 748* (Z); Grahamstown, Coombs (–BD), *Van Wyk 3204* (PRE, PRU); Alexandria, Kraaibos (–CA), *Rippon* (PRE); 2 mile NNW of Southwell (–DA), *Acocks 12077* (K, PRE); Port Alfred (–DB), *Galpin 355* (PRE).

—**3327** (Peddie): Kidds Beach, 1 km S of arrival of road on beach (–BA), *Bocquet 18317* (PRE); East London (–BB), *Galpin 1836* (K, PRE).

—**3419** (Caledon): Hermanus (–AC), *Marloth 2789* (PRE); Mossel River, near coast (–AD), *Guthrie s.n. sub PRE-59869* (PRE); Die Kelders (–CB), *Taylor 158* (NBG); Danger Point (–CD), *Hugo 1691* (PRE, STE); Zoetendals Vlei on road to Gansbaai (–DB), *Van Wyk 911* (STE).

—**3420**(Bredasdorp): Bank of Kars River on Struis Bay road (–AC), *Galpin 11275* (K, PRE); De Hoop, Potberg Nature Reserve (–BC), *Burgers 1375* (STE); Still Bay, Cape Infanta (–BD), *Rourke 1919* (NBG).

—**3421** (Riversdale): Riversdale, 10 mile SE of Riversdale (–AB), *Marais 592* (GRA, K, PRE); Duivenhoks River, Puntjie, 1 km from mouth (–AC), *Boucher 2674* (STE); Stilbaai, Slope below rubbish dump (–AD), *Bohnen 4901* (K, PRE, STE); 3 km on road from Vermaaklikheid to Puntjie about 1 km from road towards Duiwenhoks River (–BD), *O'Callaghan, Fellingham & Van Wyk 423* (STE).

—**3422** (Mossel Bay): Groot Brak River Mouth (–AA), *Parsons 385* (STE); Herold's Bay (–AB), *Fourcade 6506* (BOL); Wilderness (–BA), *Jacot Guillarmod 8315* (GRA).

—**3423** (Knysna): Knysna, The Heads (–AA), *Ross 2403* (K, PRE, STE); Plettenberg Bay (–AB), *Rogers 26818* (PRE).

—**3424** (Humansdorp): Slang River (–BA), *Phillips 3334* (PRE); Humansdorp, Boskloof (–BB), *Archer 552* (PRE, PRU).

—**3425** (Skoenmakerskop): Skoenmakerskop (–BA), *Borle 19* (K, PRE).

Species excluded:

Lauridia? multiflora Engl.: 38 (1888). = *Salvadora persica* L.

Table 4. Summary of principal characters to distinguish between *Lauridia* and *Cassine s. str.* as well as the closely related genera *Allocassine* and *Maurocenia*[1].

	Genera			
Characters	*Cassine s. str.*	*Maurocenia*	*Lauridia*	*Allocassine*
Habit	trees or shrubs	tree	small tree, shrub or liana	liana
Inflorescences				
Peduncle	present	absent	absent or present	present
Type	dichasial	irregularly dichasial	thyrsoid	dichasial
Flowers				
Pedicels	present	present	absent	absent
Sepal shape	deltoid	small, often rudimentary	widely ovate	ovate, coriaceous
Ovule orientation	erect	pendulous	erect	erect
Fruit				
Shape	globose			ellipsoid
Pericarp	fleshy			thin, leathery
Seed				
Shape	globose			ellipsoid
Pollen				
Tectum	reticulate	reticulate	perforate to smooth	
Apertural duplication	conspicuous	conspicuous	inconspicuous	
Wood				
Rays	procumbent with 2–4 rows of marginal cells occasionally square to upright	predominantly square or slightly upright		conspicuously upright
Bark				
Fibres	usually present	absent		present
Sclereids	absent	present as continous bands of densely packed chambered crystalliferous strands		absent
Rhytidome	weakly developed	well developed and ramified		absent with no sequential periderms formed
Leaf				
Epidermal cells (anticlinal cell walls)	straight to curved	straight to curved	often sinuous	

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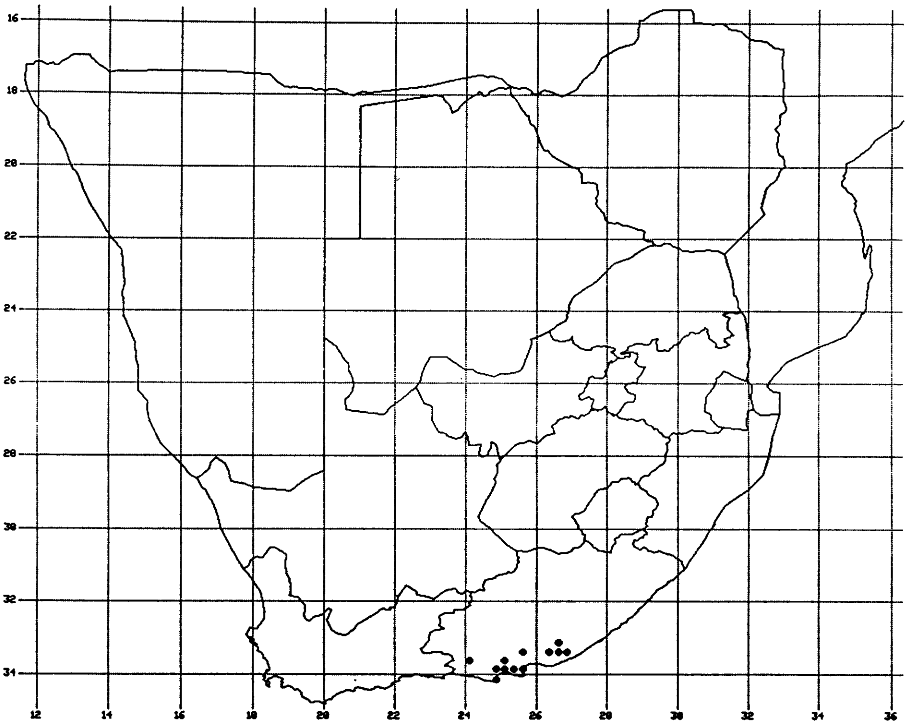
[1] Characters are fully described in Archer (1990) and Archer & Van Wyk (1992, 1993a, 1993b).

Figure 11. *Lauridia reticulata*. Flowering branch. *Marais 387* (PRE).

Figure 12. *Lauridia tetragona.* Flowering branch. Note deflexed branches. *Bohnen 4901* (PRE).



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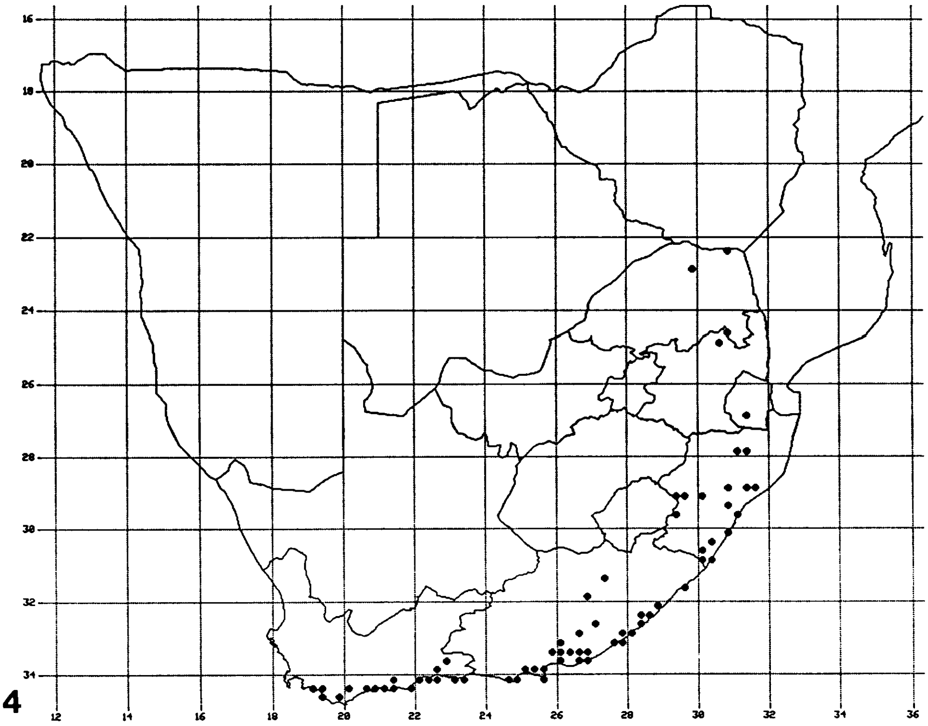

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Figures 13 & 14. Known distribution of *Lauridia*. **13.** *Lauridia reticulata*. **14.** *Lauridia tetragona*.

5.3 *ALLOCASSINE* N. ROBSON[*]

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[*] Submitted to *Bothalia*.

A taxonomic revision of *Allocassine* N. Robson, a monotypic genus in the southern African Celastraceae

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A taxonomic account is given of the genus *Allocassine* N. Robson (Cassinoideae, Celastraceae). *Allocassine* is an isolated monotypic genus remotely related to the other southern African Cassinoideae. *A. laurifolia* is a liana occurring in the eastern parts of southern Africa, Zimbabwe and Mozambique.

Introduction

Allocassine is an isolated monotypic genus not closely related to other southern African Celastraceae. It is maintained separately from the other Cassinoideae mainly on account of its pollen morphology, different flower and seed morphology, wood anatomy and the development of a single periderm which forms a thick layer of cork (Archer 1990; Archer & van Wyk 1992, 1993a, 1993b).

When describing *Allocassine*, Robson (1965) referred two species to the genus, namely *A. laurifolia* and *A. tetragona* (L.f.) N. Robson, both on account of their baccate fruit, elongate seed and climbing habit. However, it has been shown elsewhere that *A. tetragona* differs in many important characters from *A. laurifolia*, the type of the genus. The former fits best in *Lauridia* Eckl. & Zeyh., up to now considered to be a monotypic genus, with which it shares many characters.

Taxonomy

Allocassine N. Robson in Boletim da Sociedade Broteriana, ser. 2, 39: 30 (1965); N. Robson: 379 (1966); N. Robson & Sousa: 27 (1969); Codd: 124 (1966); Dyer: 334 (1975). Type species: *A. laurifolia* (Harv.) N. Robson.

Slender scrambling shrub or liana, 3–5 m high, unarmed, glabrous, without elastic threads in leaves and bark; bark greyish or light brown, periderm persistent with no sequential periderm formation observed; phellem thick, equalling the inner bark in thickness, 1–1.5 mm thick, with conspicuous orange pigment in slash, surface ± smooth. *Branchlets* terete or flattened, greyish brown. *Leaves* usually opposite or alternate on young shoots, occasionally bracteose on climbing shoots; lamina elliptic to broadly elliptic to oblong, bluish-green, glossy on both surfaces, (35–) 60–90 (–170) x (15–) 30–50 (–90) mm, base rounded to cuneate, apex rounded to retuse, rarely acute, margin entire or remotely glandular-crenulate, rigid coriaceous; venation (including reticulation) conspicuous on both surfaces, fine reticulation sometimes more conspicuous above, indistinctly brochidodromous with a tendency towards eucamptodromous; petiole 5–12 mm long; stipules minute, ± 1 mm long, ± triangular, brownish-black, caducous. *Inflorescences* pedunculate, compact dichasial with flowers sessile, axillary, 1–10 per inflorescence, peduncle 10–20 mm long; bracts minute, bracteoles occasionally present. *Flowers* bisexual, 5-merous, ± 2 mm diam. *Sepals* greenish with reddish cilia, ovate, 2 x 1.5 mm, thick, coriaceous, margin ciliolate. *Petals* yellow-green, narrowly obovate, ± 3 x 2 mm, erect, sessile, apex rounded, margin entire. *Stamens* erect; filaments 2 mm long, flattened, arising from margin of disc with which they are united at the base, anthers ± 0.8 mm long, basifixed, introrse. *Disc* fleshy, entire. *Ovary* ± ⅓ immersed in and adnate to the disc, 2-locular, with 2 erect collateral ovules per locule; styles ± 0.5 mm long; stigma inconspicuously lobed. *Fruit* baccate, red, ellipsoid, 25–32 x 18–20 mm, mesocarp fleshy. *Seed* black, narrowly ellipsoid, 15–20 mm x 5–8 mm, postchalazal vascular bundles not observed, fleshy endosperm present; embryo erect, with cotyledons fleshy, narrowly elliptic (Figure 15).

Allocassine laurifolia (Harv.) N. Robson in Boletim da Sociedade Broteriana ser. 2. 39: 30 (1965); N. Robson: 379 (1966); N. Robson & Sousa: 28 (1969); Palmer & Pitman 1323 (1973); Coates Palgrave 514 (1977); Pooley 280 (1994). Type: Natal, Port Natal, *Gueinzius 5* (K!, lecto., designated by N. Robson: 32 (1965), BM!).

Elaeodendron ? laurifolium Harv.: 54, t. 185 (1863). *Cassine laurifolia* (Harv.) Davison: 335 (1927).

Icones: Harv.: t. 185 (1863); N. Robson: 380, t. 79 (1966); Pooley: 281 (1994).

A scrambling shrub or liana, occurring in the eastern parts of South Africa and Zimbabwe and parts of Mozambique (Figure 16), associated with dry forests and forested ravines and gorges. Although fairly widespread, it is not frequently encountered. Common names: 'Laurel Saffron' or 'Lauriersaffraan' (Von Breitenbach 1987).

Selected specimens examined

Zimbabwe

—**1832** (Mutare): Inyanga, Inyanga National Park, Pungwe Gorge (–BD), Burrows 597 (NBG, SRGH); Umtali [Mutare], Eastlands (–DC), *Chase 4181* (BM, K, LISC, SRGH).

—**1932** (Melsetter): Umtali [Mutare], Vumba Mts (–BB), *Chase 5798* (BM, K, PRE); Umtali [Mutare], Vumba, Burma Valley, Old wagon road from Vumba (–BD), *Wild & Chase 5568* (K, SRGH).

—**2032** (Chipinge): Chipinge, Farm Woodbine, E of Chipinge (–BA), *Van Wyk BSA 1082* (PRE, PRU); Southern Melsetter, Ste[i]rling (–BD), *Swynnerton* (BM).

Mozambique

—**2033** (Chibabava): Manica e Sofala, Above Haroni-Makurupini Forest at southern tip of Chimanimani Mountains (–AA), *Muller 1215* (LISC, SRGH).

—**2532** (Maputo): Namaacha (–CC), *Balsinhas 503* (BM, K, LISC, PRE).

South Africa

—**2632** (Bela Vista): Tembe Elephant Park (–CD), *Ward 1144* (NH).

—**2731** (Louwsburg): Gwalaweni Forest (–BC), *Van Wyk & Potgieter 12228* (PRU); Ngome Forest (–CD), *Gerstner 4490* (PRE).

—**2732** (Ubombo): 1.6 km N of Manzengwenya (–BB), *Ward 1825* (NH, PRE); Mabibi Dune Forest S of Manzengwenya (–BC), *Buthelezi 681* (NH).

—**2831**(Nkandla):Empangeni-Nkwaleni, Waterfield Farm (–DB), *Scott-Barnes* (K); Kwa Dlangezwa, Inkonjane Creek (–DD), *Venter 3967* (K).

—**2832** (Mtubatuba): Hluhluwe Game Reserve (–AA), *Ward 2826* (NH, PRE); Mtubatuba, St. Lucia, Eastern Shores State Forest (–AB), *MacDevette 370* (NH);

Mapelane Forest (–AD), *Venter 6328* (PRE); Richards Bay, Mzingazi (–CC), *Venter 5871* (PRU).

—**2930** (Pietermaritzburg): New Hanover, 8 km S of Wartburg, Farm Windy Hill (–DA), *Balkwill & Balkwill 4709* (J); Inanda (–DB), *Wood 1858* (BOL, K, MEL); Isipingo North (–DD), *Ward 5952* (K, PRE).

—**2931** (Stanger): Harold Johnson Reserve (–AB), *Nichols 856* (NH); Hawaan Forest, S bank of Umhlanga river (–CA), *Ross & Moll 2310* (K, PRE); near Durban (–CC), *Gerrard & M'Ken 652* (TCD).

—**3030** (Port Shepstone): Near Amanzimtoti River (–BB), *M'Ken 3* (TCD); Umdonipark (–BC), *Van Wyk 5056* (PRE, PRU); Oribi Gorge Nature Reserve (–CB), *Nicholson 1042* (PRE); Umtamvuna Nature Reserve, Smedmore (–CC), *Abbott 813* (PRU).

—**3128** (Umtata): Nqabava River Mouth (–BD), *Nicholson 1460* (PRE).

—**3129** (Port St. Johns): Ngqeleni, Qokama (–CA), *Acocks 12824* (PRE); Near Port St. Johns, Sonkwe Forest (–CB), *Cooper 280* (NH); Umtata River Mouth, Mputika Forest (–CC), *Cooper 257* (NH); Port St. Johns, Bulolwe Stream (–DA), *Van Wyk 10022* (PRU); Mount Thesinger (–DA), *Van Wyk 8374* (PRU).

—**3130** (Port Edward): Along Umtamvuna River, 5 km inland (–AA), *Nicholson 1850* (PRE).

—**3228** (Butterworth): Bashee mouth, 2 mile from Bashee mouth on Elliotdale road (–BB), *Story 4126* (GRA, PRE); Dwessa road, E of office (–BD), *Abbott 2646* (NH, PRU); Dwessa Nature Reserve (–BD), *Van Wyk 8307* (PRU).

Swaziland

—**2632** (Bela Vista): Jilobi Forest (–CA), *Kemp 1334* (PRE).

Figure 15. *Allocassine laurifolia.* Flowering branch. *Medley Wood 8591* (PRE).

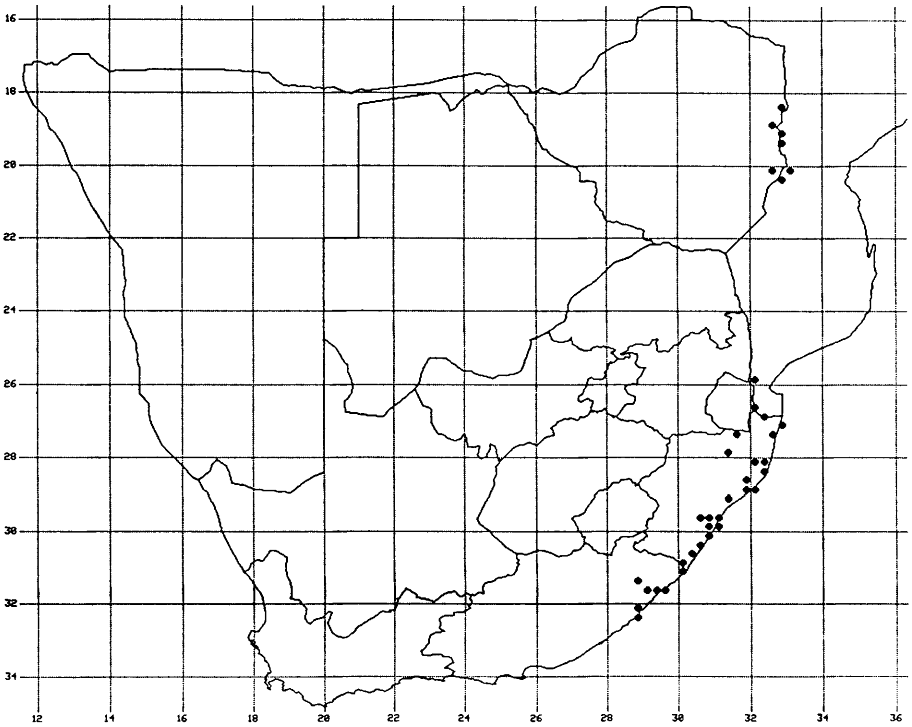

Figure 16. Known distribution of *Allocassine laurifolia.*

5.4 *MAUROCENIA* MILL.*

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*Submitted to *Bothalia*.

A taxonomic revision of *Maurocenia* Mill. (Celastraceae), a Western Cape monotypic endemic

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A taxonomic account is given of the genus *Maurocenia* Mill. (Celastraceae). It is a monotypic genus endemic to the Cape Peninsula and the West Coast National Park, Western Cape. The correct specific epithet and author citation is discussed.

Introduction

The genus *Maurocenia* is fairly similar in many anatomical and morphological features to *Lauridia* Eckl. & Zeyh. However, the pendulous ovules in *Maurocenia* set it apart from the other genera in the southern African Cassinoideae, which have erect ovules. The occurrence of pendulous ovules is relatively rare in the Celastraceae. Perhaps the genus is, on account of the ovules, more closely related to the tropical American *Tetrasiphon* Urban and *Gyminda* Sargent (Loesener 1942a; Brizicky 1964) than to the remaining southern African genera.

Maurocenia frangula was evidently not uncommon in cultivation in Europe in the 18th century, in view of the abundance of illustrations of the species. It was first introduced in 1690 to the Royal Botanic Gardens in London (Aiton 1811). In the pre-Linnaean period the species was described and illustrated by Plukenet (1691), Petiver (1702), Boerhaave (1710) and Dillenius (1732). The genus and phrase name of Dillenius (1732), *Maurocenia frangula sempervirens, folio rigido subrotundo* was taken up by Linnaeus (1737, 1743). However, in 1753 Linnaeus reduced *Maurocenia* to synonymy under *Cassine*. The name *Maurocenia* was subsequently validly published when the genus was reinstated by Miller (1754), in an attempt to rectify what he thought was an error on Linnaeus's part. The epithet *frangula* was provided later (Miller 1768), being taken up from the phrase name. Willdenow (1798) first introduced the incorrect form of the epithet, *frangularia,* which is today in general use in herbaria and in most recent literature. The author citation in general use for the taxon, i.e. (L.) Mill. (Arnold & De Wet 1993), is also incorrect.

Taxonomy

Maurocenia Mill. Gardeners Dictionary. abridg. ed. 4.: 859 (1754); Adans.: 303 (1763), as *Maurocena*; Sond.: 465 (1860); Kuntze: 147 & 149 (1891), *pro parte*, excl. subg. *Triceros* Kuntze; Thonner: 331 (1915); Davison: 343 (1927); Loes.: 179 (1942a); Dyer: 335 (1975). Type: *M. frangula* Mill.

Maurocenia Mill. subg. *Eumaurocenia* Kuntze: 149 (1891).

Small evergreen shrub to spreading tree up to 8 m high, unarmed, glabrous, without elastic threads in leaves and bark; bark greyish with layers of powdery yellow pigment in exposed rhytidome, exfoliating in thin scales, surface cracked in gridlike pattern. *Branchlets* terete or slightly flattened, greyish brown to brown. *Leaves* opposite; lamina widely elliptic to circular, dark green above, grey-green below, (25–) 35–60 (–85) x (20–) 30–55 (–65) mm, base rounded to cuneate, apex rounded to retuse, margin entire, revolute, coriaceous and rigid; venation slightly raised above and more prominent below, reticulation inconspicuous, brochidodromous, midrib and petiole very conspicuous below owing to whitish-green colour contrasting with grey-green lamina in dried leaves; petiole 2–3 mm long; stipules minute, ± 1 mm long, ± triangular, brownish-black, marcescent. *Inflorescences* sessile, ± irregularly dichasial, axillary towards apices of branchlets, 4–10-flowered; bracts minute. *Flowers* often unisexual with staminodes, or bisexual, pentamerous, ± 2 mm diam.; pedicels 2–4 mm long. *Sepals* rudimentary, ± 0.3 mm long. *Petals* white, ovate, 1.3 x 1 mm, sessile, apex rounded, margin ± deflexed. *Stamens* ± erect; inserted below margin of disc; filaments of perfect flowers 3–4 mm long, well exserted above flowers; filaments of female flowers rudimentary (staminodes); anthers of perfect flowers 0.8 mm long, basifixed, introrse, dehiscing by longitudinal slits. *Disc* fleshy, entire, undulate. Ovary ± ⅓ immersed in and adnate to disc, 2(3)-locular with 2 pendulous collateral ovules per locule, ovules epitropous, dorsal; styles ± 0.25 mm long; stigma in female flowers often conspicuously 2-lobed, papillate, stigma inconspicuous in perfect flowers. *Fruit* baccate, pale red, spheroid, 7–10 mm diam., mesocarp fleshy. *Seed* 1 or 2 per locule (up to 5 per fruit recorded), brown, ± spheroid, post-chalazal vascular bundles not observed, fleshy endosperm present; embryo erect, with cotyledons fleshy, widely elliptic, base unequal (Figure 17).

Maurocenia frangula Mill., Gardeners Dictionary ed. 8.: MAU (1768); Willd.:1493 (1798), in syn. as *frangularia*; Pers.: 327 (1805); Marloth: 153 (1925); Davison: 343 (1927); Loes.: 179 (1942a); Adamson: 567 (1950); Levyns: 190 (1966); Von Breitenbach: 640 (1966); Palmer & Pitman: 1324 (1973); Coates Palgrave: 515 (1977); Bond & Goldblatt: 224 (1984). Type: Dillenius, Hortus Eltham. t. 146, f. 147 (1732), lecto., here designated.

Cassine maurocenia L. 269 (1753); 385 (1762); Willd.: 1493 (1798); Thunb.: 52 (1794a); 225 (1818); 268 (1823); Ait.: 170 (1811); Roem. & Schult.: 466 (1819); Spreng.: 939 (1825); Eckl. & Zeyh.: 128 (1834/5); Hook.: t. 552 (1843); Sond.: 465 (1860); Hook. f.: 363 (1862); Szyszyl.: 33 (1888).

Icones: Plukenet: t. 158, f. 2 (1691); Petiver: t. 57, f. 4 (1702), Boerhaave: 244 (1727); Dillenius: t. 146, f. 147 (1732); Hook.: t. 552 (1843); Marloth: t. 51 (1925); Davison: t. 19 (1927); Von Breitenbach: 641 (1965).

Maurocenia is a monotypic genus of mountain kloofs and coastal bush on rocky sea shores in the Cape Peninsula and near Stellenbosch (Figure 18). It is frequent on the footpaths in the kloofs of Table Mountain. The wood is hard and has a fine grain, and has been used in the manufacturing of musical instruments (Pappe 1854). Vernacular names are 'Hottentot's cherry' and 'Hottentotskersie', referring to the fruit which is edible and was eaten by Hottentots. The genus name commemorates the Italian horticulturist, F. Mauroceni.

Specimens examined

—**3318** (Cape Town): West Coast National Park, Postberg peninsula (–AA), *Van Wyk BSA 142* (PRU); 'Montis tabularis' (Table Mountain) (–CD), *Marloth* 97 (PRE); Camps Bay (–CD), *Marloth* 5978 (PRE); Table Mountain, Grotto Ravine (–CD), *Marloth* 12044 (PRE); Camps Bay (–CD), *Maude* (BM); *Prior PRE-47256* (PRE, Z); Stellenbosch, ridge behind Swartboskloof, adjoining Haelkop (–DD), *Taylor* 7301 (PRE).

—**3418** (Simonstown): Muizenberg, near False Bay (–AB), *MacOwan* 580 (BOL, BM, PRE, Z); slopes above Bakoven Bay (–AB), *Marais* 601 (BOL, PRE); Blackburn Kloof near Hout Bay (–AB), *Marais 606* (PRE); Jagersfontein (–AB), *Pole Evans* 4349 (PRE); Hout Bay (–AB), Hout Bay (–AB), *Rehman* 1609 (Z); *Smuts 1154* (PRE); Boyes Drive, opp. St. James, between Muizenberg and Kalkbaaiberg (–AB), *Stauffer & Esterhuysen 5123* (PRE, Z); boulder near summit of Steenberg (–AB), *Taylor 3296* (PRE); Cape of Good Hope Nature Reserve, Booiseskerm (–AB), *Taylor* 10531 (C, PRE); Cape Peninsula, West Coast opposite Antipolis shipwreck (–AB), *Van Jaarsveld 3154* (PRE); Chapmans Peak (–AB), *Van Jaarsveld* 3171b (PRE); Hout Bay (–AB), *Wolley Dod* 1045 (BM); Simonstown, Smitswinkelbaai (–AD), *Schlechter* 700 (Z); Eastern side of Hangklip Peak, facing Blesberg (–BD), *Rourke 1855* (NBG, PRE).

Species excluded or insufficiently known:

M. americana Mill.
M. arguta (Lindl.) Kuntze: 149 (1891) = *Turpinia* sp.
M. cerasus Mill.
M. cochinchinensis (Lour.) Kuntze: 150 (1891) = *Turpinia* sp.
M. heterophylla (Ruiz & Pav.) Kuntze: 150 (1891) = *Turpinia* sp.
M. insignis (Kuntze) Kuntze: 149 (1891) = *Turpinia* sp.
M. occidentalis (Swartz) Kuntze: 150 (1891) = *Turpinia* sp.
M. phylliraea Mill.
M. pinnata (Schiede ex Schlecht.) Kuntze: 150 (1891) = *Turpinia* sp.
M. pomifera (Roxb.) Kuntze: 147 & 149 (1891) = *Turpinia* sp.
M. schinziana Loes.: 194 (1894) = *Cassine parvifolia* Sond.
M. simplicifolia (Gardn. & Champ.) Kuntze: 149 (1891) = *Turpinia* sp.
M. sphaerocarpa (Hassk.) Kuntze: 147 & 150 (1891) = *Turpinia* sp.
M. zollingeri Kuntze: 147 (1891) = *Turpinia* sp.

Figure 17. *Maurocenia frangula*. Branch with female flowers. *McOwan 2334* (PRE).

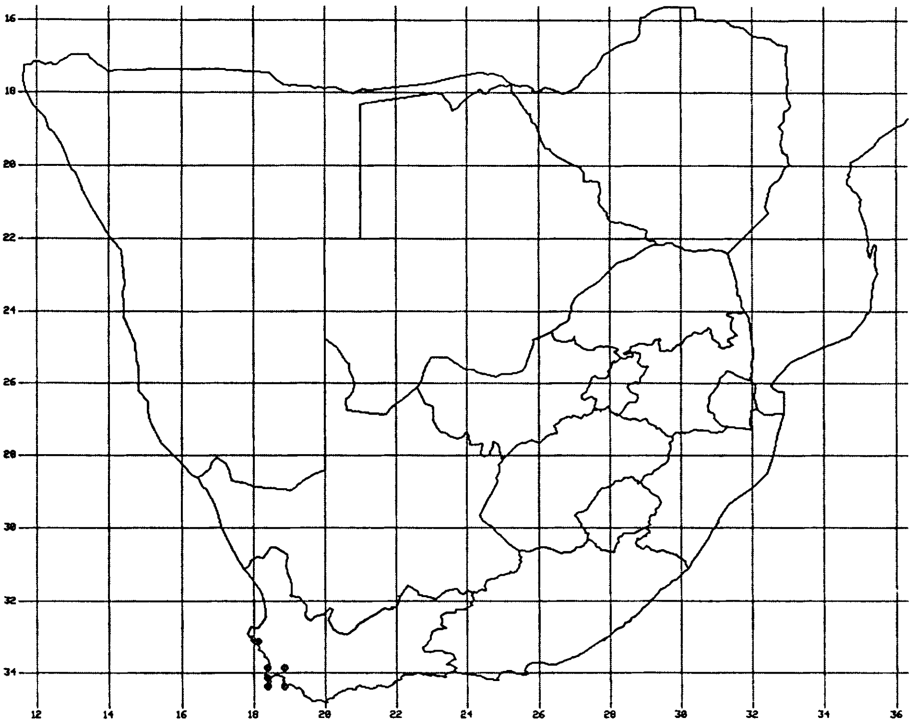

Figure 18. Known distribution of *Maurocenia frangula*.

5.5 *ROBSONODENDRON* R.H. ARCHER[*]

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[*] Submitted to *South African Journal of Botany*.

A taxonomic revision of *Robsonodendron*, a new genus in the Cassinoideae (Celastraceae)

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Robsonodendron, a new woody genus endemic to southern Africa, is described. Its two species have hitherto been included in either *Cassine s.l.* or *Mystroxylon.* The new genus is related to *Mystroxylon* Eckl. & Zeyh. and the *Maytenus acuminata* (L.f.) Loes. complex (subfamily Celastroideae), but differs in several important morphological, palynological and anatomical characters. A taxonomic revision of the genus is provided in which two new combinations, *Robsonodendron eucleiforme* (Eckl. & Zeyh.) R.H. Archer and *R. maritimum* (H. Bol.) R.H. Archer, are proposed.

Introduction

Available evidence strongly supports the splitting of *Cassine* into a number of segregate genera. One of these, *Mystroxylon*, proved to be a heterogeneous taxon, with two of its species best placed in a genus of their own, previously referred to as Genus A (Archer 1990). A new genus, *Robsonodendron*, is proposed here for its two closely related species, usually referred to as *Cassine eucleiformis* (Eckl. & Zeyh.) Kuntze and *C. maritima* (H. Bol.) L. Bol., both of which are endemic to southern Africa.

Depending on the authority, the two members of *Robsonodendron* were previously included in either *Mystroxylon* or *Cassine s.l.* However, they differ from both genera in several important characters, including those from palynology, leaf, wood and bark anatomy, as well as general macromorphology. A summary of the principal diagnostic characters for distinguishing *Robsonodendron* from *Cassine* and *Mystroxylon* are presented in Table 5. These characters and their taxonomic significance are fully described in Archer (1990) and Archer & Van Wyk (1992, 1993a, 1993b, in press a). Diagnostic characters for separating the new genus from *Mystroxylon*, include evidence from pollen morphology, the presence of elastic material (presumably *trans*-1, 4-

polyisoprene) and styloid crystals of calcium oxalate in the phloem, a two- instead of three-locular ovary, and a linear instead of foliar embryo.

Affinities of *Robsonodendron* are obscure, but should perhaps be sought with *Maytenus acuminata* (L.f.) Loes. and allies, rather than with *Mystroxylon* or *Cassine*. Sterile plants of *Robsonodendron eucleiforme* are often confused with *Maytenus acuminata*, with which it shares many similarities, notably the presence of elastic threads in the leaf and bark (Geldenhuis 1981). These elastic threads, which are clearly visible on breaking the leaf lamina, are a useful diagnostic character for the field identification of *Robsonodendron*, *Maytenus acuminata* and two other southern African species of *Maytenus* (Van Wyk 1984). In southern Africa, similar threads are also found in some members of the genus *Salacia* L. (Hippocrateaceae of some authors) and elsewhere in some species of *Hippocratea s.l.* The fine threads reported in broken leaves of other species of *Cassine s.l.* and in *Hartogiella* (Palmer & Pitman 1973), are not rubber, but merely the torn remains of fibres and vessels.

The name *Robsonodendron* commemorates the eminent plant taxonomist, Dr. N.K.B. Robson, of the Natural History Museum, London. His original approach in recognizing a number of segregate genera within *Cassine s.l.* in southern Africa has subsequently received strong support from various sources of taxonomic evidence (e.g. Robson 1965, 1966; Robson *et al.* 1994). Loesener (1942a) first acknowledged the distinctness of the two species now placed in *Robsonodendron*, by erecting a new section, *Pseudoscytophyllum* Loes. under *Mystroxylon*. Robson (1965), while using *Mystroxylon* in the broader sense, recommended further study to clarify the possible diphyletic groups within *Mystroxylon*.

Taxonomy

Robsonodendron R.H. Archer gen. nov. *Mystroxyli* Eckl. & Zeyh. affinis, sed foliis glabris, filibus laticis in foliis corticeque ruptis visibilibus, crystallis styliformis in cortice vivo, ovario biloculare, fructu albido vel ochraceo (non rubenti), embryone lineari differt; a *Cassini sensu strictiore* foliis alternis, inflorescentia fasciculata, fructu drupaceo, endocarpo tenui, crustaceo, differt.
TYPUS: *Robsonodendron eucleiforme* (Eckl. & Zeyh.) R.H. Archer.

Mystroxylon Eckl. & Zeyh. sect. *Pseudoscytophyllum* Loes.: 178 (1942).

Evergreen shrubs or trees; glabrous with elastic threads of presumably *trans*-1, 4-polyisoprene in bark and leaves; bark without yellow pigment. *Branchlets* ± 4-lined, more or less rugulose. *Leaves* alternate; elastic (rubber) threads evident on breaking the lamina; stipules minute, 0.5–1 mm long, marcescent, brownish black. *Inflorescences* sessile, composed of fasciculate cymes. *Flowers* bisexual, 5-merous, pedicellate. *Sepals* unequal, outermost pair larger, fleshy, ± deltoid, laciniate; inner pair membranous, enlarged, remaining one ± intermediate between outer and inner pair. *Petals* cream, oblong, margin entire. *Stamens* erect, arising from the margin of the disc with which they are united at the base; anthers introrse, dehiscing by longitudinal slits. *Disc* fleshy, entire. *Ovary* ± ⅓ immersed in and adnate to the disc, 2-locular, with two erect, collateral ovules per locule; style very short or absent; stigma inconspicuously lobed. *Fruit* a drupe, white or yellow to light brown, spheroid, 5–10 mm diam.; endocarp thin and crustaceous; mesocarp fleshy. *Seeds* one or two per fruit; seed-coat brown, postchalazal vascular bundles not observed; endosperm present, fleshy; embryo erect, linear.

Diagnostic features

Previously treated under *Mystroxylon* or *Cassine s.l.* but distinguishable on the basis of several morphological and anatomical characters (Table 5).

Key to the species of *Robsonodendron*

1a. Tree up to 12 m high; leaf lamina with margin plane, apex usually rounded or acute; petioles, midrib and young stems smooth to slightly rugulose .... *R. eucleiforme*

1b. Shrub up to 2 m high; leaf lamina with margin revolute, apex usually acute and mucronate; petioles, midrib and young stems prominently rugulose .... *R. maritimum*

1. ***Robsonodendron eucleiforme*** (Eckl. & Zeyh.) R.H. Archer, comb. nov. Type: Cape, Uitenhage, 'Krakakamma. Fruct. Feb.', *Ecklon & Zeyher s.n.* (S!, holo.; C!, B!, K!, MEL, MO, PRE!, P!, SAM!, UPS!).

Mystroxylon eucleiforme Eckl. & Zeyh.: 125 (1834/5); Sond.: 470 (1860). *Elaeodendron eucleiforme* (Eckl. & Zeyh.) Ettingshausen: 60 (1857). *Cassine eucleiformis* (Eckl. & Zeyh.) Kuntze: 114 (1891); Davison: 327 (1927); Henkel: 60 & 82 (1934); Von Breitenbach: 633 (1965); Palmer & Pitman: 1309 (1973); Compton: 33 (1976); Coates Palgrave: 510 (1977); Geldenhuis: 96–98 (1981); Bond & Goldblatt: 223 (1984); Moll: 103 & 223 (1992); Pooley: 278 (1993) *pro parte* excl. photo.

Mystroxylon oligocarpum Eckl. & Zeyh.: 125 (1834/5). *Elaeodendron oligocarpum* (Eckl. & Zeyh.) Ettingshausen: 57 (1857). Type: Uitenhage, 'Van Stadensriviers- et Winterhoeksberge. Fruct. Jul.'. *Ecklon & Zeyher s.n.* (S!, lecto, here designated; C!, K!, P!, PRE!, SAM!, Z!).

Scytophyllum angustifolium C. Presl ex Sond.: 472 (1860). *Elaeodendron* (*Scytophyllum*) *angustifolium* C. Presl: 34 [464] (1845), *nom nud. Gymnosporia angustifolia* (C. Presl ex Sond.) Loes.: 208 (1892) H. Bol. & Wolley-Dod: 247 (1904); F. Bol. & L. Bol.: 182 (1915); Davison: 300 (1927). *Maytenus angustifolia* (C. Presl ex Sond.) E. Moll & L.B. Scott: 58 (1981), comb. illeg. Type: Mountains near Cape Town. *Ecklon & Zeyher s.n.* (S!, lecto, here designated; GRA!).

Myrsine gerrardii Harv. & Wright: 436 (1906). Type: Zululand, *Gerrard 1157* (K!, holo.).

Gymnosporia amapondensis Sim: 187 (1907). Type: Transkei, Egossa, *Sim 2469* (NU, holo.; GRA!, SAM!, PRE!).

Slender tree up to 12 m high; bark greyish, surface longitudinally and transversely fissured, fissures often cutting deep into the rhytidome layers. *Branchlets* prominently 4-lined when young, slightly rugulose, becoming terete, greyish brown. *Leaves* with lamina elliptic to ovate or obovate, light green above and below, (15–) 25–45 (–75) x (4–) 8–20 (–35) mm, base attenuate to cuneate, apex rounded to acute, margin entire or glandular-crenate (usually 2–4 crenations on each side), subcoriaceous; venation brochidodromous, ± smooth in fresh material, ± raised above and below in dried material, midrib smooth; petiole 3–4 mm long. *Inflorescences* axillary, 1–14-flowered; bracts minute. *Flowers* ± 2 mm diam.; pedicels ± 2 mm long. *Sepals* greenish, outer pair fleshy, ± deltoid with apex rounded, margin sparingly ciliate, inner pair membranous, ± subrotund, enlarged, ± 1 mm long, ± 1.5 mm wide, margin conspicuously and sharply laciniate, remaining one ± intermediate between outer and inner pair. *Petals* cream, oblong, 1.7–2.5 x 0.7–1.5 mm, sessile, apex rounded, margin entire, erect. *Stamens* erect, ± 0.7 mm long, anthers ± 0.3 mm long, subdorsifixed, introrse. *Disc* with slightly upturned margin. *Ovary* with style ± 0.2 mm long or astylous. *Fruit* yellow to light brown when ripe, ± 5 mm diam. *Seed* usually single (Figure 19).

Robsonodendron eucleiforme is a small to medium size evergreen tree up to 12 m high. It occurs in coastal forest and forest margins in the Western and Eastern Cape, and KwaZulu-Natal. In Mpumalanga and Northern Province it prefers higher altitude (Afromontane) forests, usually occurring on the forest margins (Figure 21). Flowering and fruiting sporadically throughout the year.

In the absence of fruit, *R. eucleiforme* is frequently confused with the capsular-fruited *Maytenus acuminata*, especially in the southern Cape coastal forests. Most older literature on these forests discusses *R. eucleiforme* under the name of *M. acuminata* (Geldenhuis 1981). Both species are characterized by the presence of fine elastic threads shown on breaking of the leaf lamina. However, the leaves of *M. acuminata* are ovate to lanceolate and acuminate and the venation is more prominent and translucent. *R. eucleiforme* is a taller and much more prominent forest tree than *M. acuminata*, a species usually restricted to forest margins and rocky outcrops near streams.

Smith (1966) recorded the Afrikaans vernacular names, 'Witsybas' for *R. eucleiforme*, and 'Sybas' or 'Rooisybas' for *M. acuminata*. For the first mentioned species Von Breitenbach (1987) added 'Bastersybas' and 'White silky bark' as the Afrikaans and English vernacular names respectively.

Sonder (1860) cited *Mystroxylon filiformis* (Thunb.) Eckl. & Zeyh. under *M. eucleiforme* Eckl. & Zeyh. but with the basionym, *Celastrus filiformis* Thunb. (1794a & 1823) excluded. This suggests that Sonder correctly did not regarded *C. filiformis* as belonging to *M. eucleiforme* (Ross 1974). Ross (1974) recognized the type as a species of *Secamone* and effected a new combination. Davison (1927) incorrectly cited the basionym as a synonym of her *Cassine eucleiformis.*

Selected specimens examined

Swaziland

—**2531** (Komatipoort): Piggs Peak, Emlembe (–CC), *Compton 32307* (PRE); Piggs Peak, Devils Bridge (–CD), *Compton 31499* (K, NBG, PRE).

—**2631** (Mbabane): Sibebe Hill, 7 km NE of Mbabane (–CB), *Prior 278* (K, PRE).

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—**2229** (Waterpoort): Hanglip (–DD), *Bremekamp & Schweickerdt 416* (PRE).

—**2230** (Messina): Soutpansberg, Farm Louisville 33 LS (–AB), *Venter 8733* (PRE); Entabeni Forest Reserve (–BB), *Codd 3029* (K, PRE); Dzamba, ± 1 km from Dzamba to Rambuda (–CD), *Van Wyk 4097* (PRE, PRU).

—**2328** (Baltimore): Blouberg, Kloof E of Ga-Monnaasenamoriri Mt. (–BB), *Archer 528* (PRE, PRU).

—**2330** (Tzaneen): New Agatha Forest Reserve, Wolkberg 634 LT (–CC), *Muller & Scheepers 197* (K, PRE).

—**2429** (Zebediela): Farms Spain-Portugal beacon (–AA), *Maguire 2669* (BOL, NBG, PRE); Bewaarkloof Nature Reserve, Ribbokkop Ridge (–BB), *Stalmans 1966* (J).

—**2430** (Pilgrim's Rest): Wolkberg Wilderness Area, Serala Peak, Farm Wolkberg 634 LT (–AA), *Venter 11748* (PRE); Tzaneen, Farm Balloon 71 KT (–AB), Venter 7190 (PRE); Farm Strassburg, NE slope of Escarpment (–AD), *Fourie 3037* (PRE); Lulu Mountains, Farm Groot Vygenboom (–CA), *Mogg 13809* (K, PRE); Mariepskop, mountain forest near summit (–DB), *Van der Schijff 4499* (K, PRE, PRU); Pilgrim's Rest, 10 mile from Pilgrim's Rest on the Pretoria road (–DC), *Story 4008* (GRA, K, PRE); God's Window (–DD), *Davidson & Mogg 33346* (J, LISC, PRE).

—**2530** (Lydenburg): Dullstroom, River bank above Crocodile River Falls (–AC), *Galpin 13348* (K, PRE); Rietvlei [Rietvlei Mine?] (–BC), *Smuts 14* (PRE); Lydenburg, Carolina, Farm Goedgelegen 393 JT (–CD), *Balkwill & Balkwill 6495* (J); Starvation Creek Nature Reserve (–DA), *Kluge 1068* (PRE).

—**2730** (Vryheid): Utrecht, Donkerhoek (–AD), *Devenish 1146* (K, PRE); Luneburg, Ngcaka Mt., La Bella Esperance Farm (–BC), *Cooper 261* (PRE).

—**2731** (Louwsburg): Ngotshe, Ngome Forest (–CD), *Gerstner 4389* (PRE).

—**2732** (Ubombo): Kosi Lake, margin of swamp forest (–BB), *Moll & Nel 5615* (K, PRE); Manzengwenya, S of Lala Nek (–BD), *Buthelezi 649* (PRE).

—**2830** (Dundee): Weenen, Mt. Maria (–CC), *Pentz 294* (K, PRE); Qudeni Forest (–DB), *Gerstner 3238* (K, MO, PRE). Greytown, Farm Keerom (–DC), *Cooper 172* (K, PRE).

—**2831** (Nkandla): Nkandla (–CA), *Gerstner 3225* (PRE); Ngoye Forest Reserve, The Dome (–DC), *Balkwill et al. 1343* (C, K, MO, PRE, S).

—**2832** (Mtubatuba): Maphelane Nature Reserve (–AD), *MacDevette 222* (K, PRE).

—**2930** (Pietermaritzburg): New Hanover, Blinkwater (–BC), *Sim 20409* (PRE).

—**3030** (Port Shepstone): Oribi Gorge Nature Reserve (–CB), *McClean 334* (K, MO; PRE); Umtamvuna Nature Reserve, Beacon Hill, West (–CC), *Venter 1034* (K, PRE).

—**3129** (Port St Johns): Fraser's Falls (–BC), *Acocks 13435* (PRE); Msikaba River, between Lambasi and Ndindindi Store (–BD), *Strey 8910* (K, MO, PRE).

—**3130** (Port Edward): Umtamvuna Nature Reserve, Beacon Hill, East (–AA), *Strey 7246* (K, PRE, S).

—**3224** (Graaff-Reinet): Graaff-Reinet, banks of Zondag River (–BA), *Bowie 3* (BM).

—**3225** (Somerset East): Uitenhage, Krakakamma (–CD), *Ecklon & Zeyher s.n.* (B, PRE, S).

—**3320** (Montagu): Grootvadersbos (–DD), *Van Wyk 1242* (K, PRE, STE).

—**3322** (Oudtshoorn): George, Groenkop Forest (–DC), *Geldenhuys 266* (PRE).

—**3323** (Willowmore): Haarlem (–CB), *Thode A2435* (PRE); Deepwalls Forest Reserve (–CC), *Bos 901* (B, LISC, PRE); Bietou River Valley, near Pig a Chicken Farm (–CD), *Hugo 2115* (PRE, STE).

—**3325** (Port Elizabeth): Groendal Wilderness Reserve, Grootwaterkloof (–CA), *Scharf 1118* (K, PRE); Groendal Wilderness Reserve, Vermaakskop (–CB), *Scharf 1635* (K, PRE, NBG); Longmore Forest Reserve (–CC), *Marais 720* (BOL, GRA, K, P, PRE).

—**3418** (Simonstown): Table Mountain, Orange Kloof (–AB), *Esterhuysen 32438* (PRE).

—**3422** (Mosselbay): Silverrivier (–AB), *Schlechter 2377* (C, GRA, PRE); Wilderness Forest near townships (–BA), *Jacot-Guilarmod 8608* (GRA).

—**3423** (Mossel Bay): Harkerville Forest Reserve (–AA), *Botha 3025* (PRE).

—**3424** (Humansdorp): Humansdorp, Boskloof Wandelpad (–BB), *Archer 570* (PRE).

2. ***Robsonodendron maritimum*** (H. Bol.) R.H. Archer, comb. nov. Type: Cape, Fish Hoek, *Bolus 4767* (BOL!, lecto., here designated; BM!, K!).

Celastrus maritimus H. Bol.: 173 (1888). *Cassine maritima* (H. Bol.) H. Bol. & L. Bol.: 182 (1915); Davison: 327 (1927); Adamson: 567 (1950); Bond & Goldblatt: 223

(1984); Bohnen: 44 (1986). *Mystroxylon maritimum* (H. Bol.) Loes.: 178 (1942a); N. Robson: 30 (1965).

Shrub up to 2 m high; bark greyish, surface smooth or finely fissured. *Branchlets* 4-lined, prominently rugulose, becoming terete, greyish brown. *Leaves* with lamina widely elliptic to widely ovate, light green above and below, (10–) 15–30 (–40) x (5–) 9–15 (–22) mm wide, base attenuate to cuneate to rounded, apex acute to rounded, usually mucronate, margin entire, revolute, rugulose, coriaceous; venation obscure in fresh and dried material; petiole ± 2 mm long, rugulose. *Inflorescences* axillary, 1–5-flowered; bracts minute. *Flowers* ± 3 mm diam.; pedicels 2–3 mm long. *Sepals* greenish, outer pair fleshy, ± deltoid, apex rounded, margin entire, involute, inner pair stiffly membranaceous, ± subrotund, enlarged, ± 2 x 2 mm, margin sharply laciniate, remaining one ± intermediate between outer and inner pair. *Petals* cream, oblong, ± 2.3 x 1.3 mm, sessile, apex rounded, margin entire, ± erect. *Stamens* erect, ± 1 mm long, anthers ± 0.3 mm long, basifixed, introrse. *Disc* with upturned margin. *Ovary* with style ± 0.2 mm long. *Fruit* white when ripe, 5–10 mm diam. *Seeds* 1 or 2 per fruit (Figure 20).

Robsonodendron maritimum is a dwarf to large shrub, growing in coastal dune vegetation between the Cape Peninsula in the Western Cape and Port Elizabeth in the Eastern Cape (Figure 22). It is seldom very frequent. Sim (1907) regarded it as useful in stabilizing sand. Flowering time mainly between June and October. Ripe fruit collected mainly late summer.

Bohnen (1986) recorded 'Dune saffron' as a English vernacular name. Perhaps 'Dune silky bark' or 'Duinsybas' would be more appropriate, and are here proposed as English and Afrikaans vernacular names. The peculiar white fruit might be an adaptation to bird dispersal.

In the Cape Peninsula, apart from the presence of elastic threads in the leaves, it is often difficult to distinguish this species from *Maytenus lucida*, with which it shares the same habitat and a similar leaf shape and texture.

Selected specimens examined

—**3322** (Outshoorn): Wilderness, Fairy Knowe (–DC), *Mogg 11811* (PRE).
—**3323** (Willowmore): Knysna, Forest Hall, (–CD), *Keet 562* (GRA, PRE, STE).

—**3325** (Port Elizabeth): Port Elizabeth, Humewood, (–DC), *Long 1372* (GRA, K, PRE).

—**3326** (Grahamstown): Alexandria, on sandhills near beach at Richmond (–CB), *Galpin 10698* (PRE); Alexandria, Bushman's River Mouth (–DA), *Archibald 3650* (GRA, K, PRE), Kowie, Salt vlei (–DB), *Britten 2926* (GRA, PRE).

—**3327** (Peddie): Fish River (–AC), *O'Callaghan 1074* (GRA); East London, on sea coast (–BB), *Galpin 1847* (BOL, PRE); Tharfield Farm, Between Riet and Kleinemonde Rivers (–CA), *Lubke 2341* (GRA).

—**3418** (Simonstown): Middle Beach (–AB), *Marais 614* (GRA, K, P, PRE); Cape of Good Hope Nature Reserve, near Rheboksdam (–AD), *Taylor 9302* (K, MO, PRE, STE); 0.5 mile inland from Swartklip (–BA), *Taylor 7313* (PRE, STE); Daskop dune S of Hangklip Kloof (–BD); *Boucher 1928* (K, PRE, STE).

—**3419** (Caledon): Hermanus, Voëlklip, grotto (–AD), *Williams 274* (K, MO); Die Kelders (–CB), *Taylor 3459* (PRE, STE); Ratel River Mouth (–DC), *O'Callaghan, Fellingham & Van Wyk 476* (PRE, STE).

—**3420** (Bredasdorp): Potberg Nature Reserve, Dronkvlei (–BC), *Burgers 2122* (PRE); near the village of Arniston (–CA), *Taylor 3798* (K, PRE, STE).

—**3421** (Riversdale): Still Bay, slope below rubbish dump (–AD), *Bohnen 4884* (K, PRE, STE); Canca, SE of Albertinia (–BC), *Oliver 5731* (STE); Duiwenhoks River, dunes (–BD), *O'Callaghan, Fellingham & Van Wyk 434* (PRE, STE).

—**3422** (Mossel Bay): Goukamma Nature Reserve (–BB), *Prov. Admin. Nature Conservation 207* (PRE).

—**3423** (Knysna): Knysna, Steenbok Island (–AA), *Kapp 66* (PRE); Plettenberg Bay (–AB), *Burchell 5320* (GRA, K, MEL, PRE, S).

—**3424** (Humansdorp): Jeffreys Bay (–BB), *Fourcade 3273* (BOL, K, PRE, STE).

—**3425** (Skoenmakerskop): Skoenmakerskop (–BA), *Paterson 2287* (BOL, PRE).

Table 5. Comparison of selected anatomical and morphological features in *Robsonodendron, Mystroxylon s. str.* and *Cassine s. str.*

Features	***Mystroxylon s. str.***	***Robsonodendron***	***Cassine s. str.***
Morphology			
Branchlets	smooth, pubescent	rugulose, glabrous	smooth, glabrous
Leaves	alternate		opposite
Inflorescences	fasciculate, pedunculate	fasciculate, sessile	dichasial, pedunculate
Flowers			
number of flower parts	5		4 or 5
sepals	equal, deltoid and pubescent	unequal, outer pair fleshy and deltoid, inner ones membranous and larger than outer, glabrous	equal, deltoid to suborbicular, glabrous
locules in ovary	3 or 4	2	2 or 3
Fruit[1]			
Type	Drupe; endocarp thin crustaceous, consisting of 1 or 2 layers of palisade-like sclereids which can be easily removed from mesocarp		Berry
mesocarp	often partly sclerified	fleshy	fleshy to leathery
colour when ripe	red or yellow	yellow or white	brown, purplish or black
Seed[1]			
seed-coat	thin, ± 0.1 mm thick	thin, ± 0.1 mm thick	relatively thick, 0.3–1 mm thick
Post chalazal vascular bundles	often present	absent	
embryo	foliar	linear	foliar

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[1] Archer (1990).

Features	***Mystroxylon s. str.***	***Robsonodendron***	***Cassine s. str.***
Pollen[2]			
Tectum	reticulate with wide (1–3.5 µm) lumina	reticulate with narrow (0.5 µm) lumina.	reticulate with narrow to wide (0.5–2 µm) lumina.
Sexine	thicker than nexine	relatively thin, equal in thickness to nexine	thicker than nexine
Wood[3]			
Apotracheal bands	consists of axial parenchyma		consists of septate libriform fibres
Bark[4]			
Sclereids	large primary (brachy-) schlereids present in secondary phloem	schlerenchymatous tissue absent	fibres usually present
Styloid crystals	absent	present in phloem	absent
Elastic threads (*trans*-1,4-polyisoprene)	absent	present	absent
Phellem	homogeneous	homogeneous	often stratified
Inner bark	(3)5–10 mm wide	2–4 mm wide	1.5–3 mm wide
Leaf anatomy[5]			
Hairs	short unicellular hairs present	hairs absent	
Epidermal cells in transverse section	periclinally elongated in transverse section	anticlinally elongated (palisade-like)	periclinally elongated
Hypodermis	often present	absent	
Vascular bundle extention sheath	present	absent (elastic threads in the same position)	usually present
Elastic threads evident when breaking lamina (*trans*-1,4-polyisoprene)	absent	present	absent
Stomata type	laterocytic	latero-cyclocytic	cyclocytic

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[2] Archer & Van Wyk (1992).

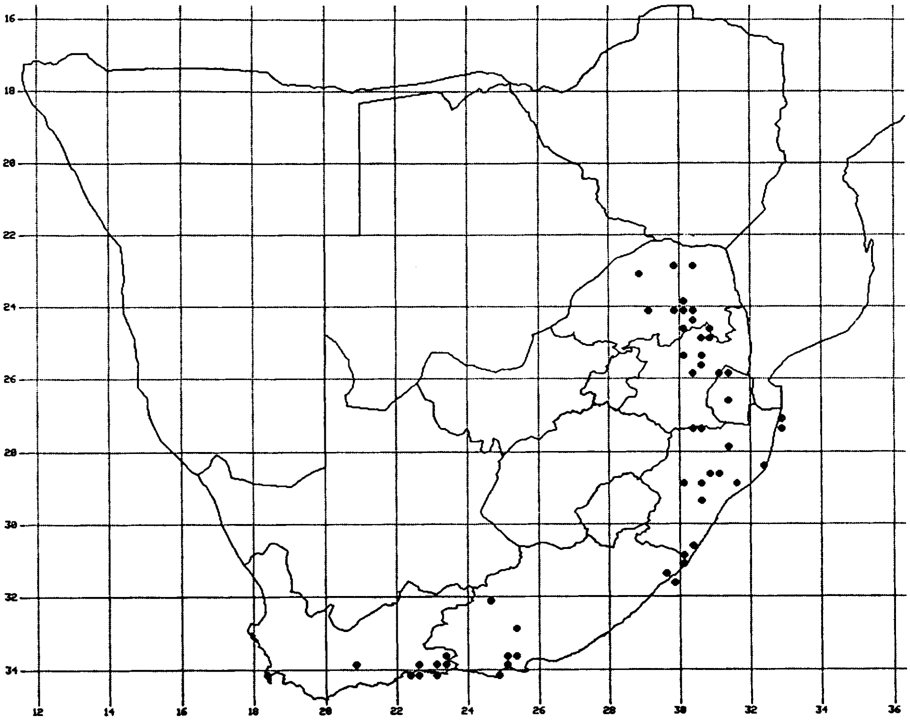
[3] Archer & Van Wyk (1993b).

[4] Archer & Van Wyk (1993a).

[5] Archer (1990).

Figure 19. *Robsonodendron eucleiforme*. Fruiting branch. *Balkwill et al. 1343* (PRE).

Figure 20. *Robsonodendron maritimum.* Fruiting branch. *Rourke 431* (PRE).



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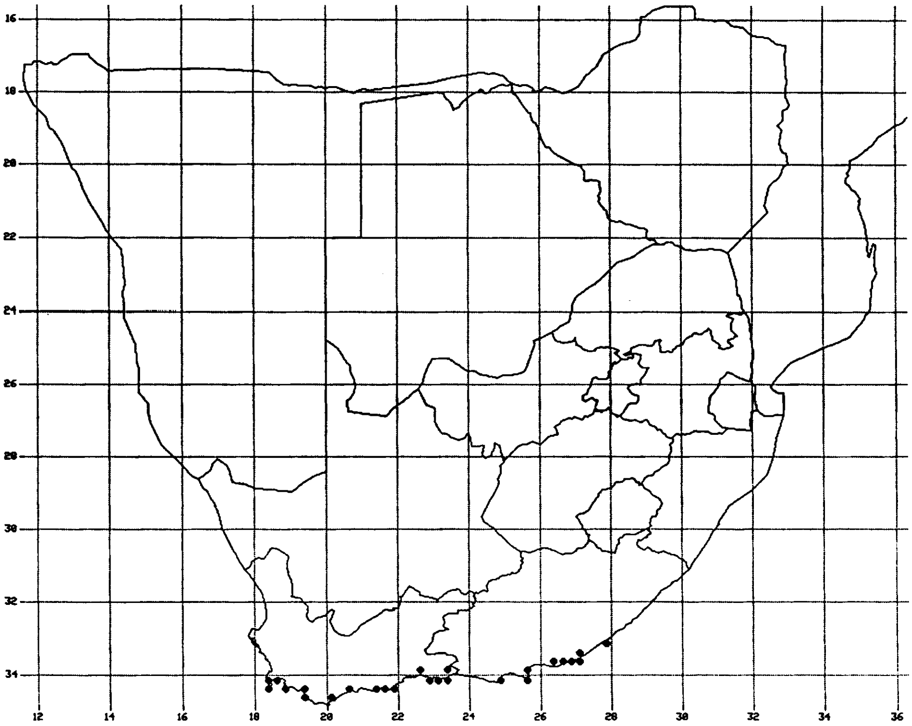

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Figures 21 & 22. Known distribution of *Robsonodendron*. **21.** *Robsonodendron eucleiforme*. **22.** *Robsonodendron maritimum*.

5.6 *MYSTROXYLON* ECKL. & ZEYH.[*]

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A taxonomic revision of *Mystroxylon* Eckl. & Zeyh. (Cassinoideae: Celastraceae) in southern Africa

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A taxonomic account is given of *Mystroxylon* Eckl. & Zeyh. in southern Africa. The genus is treated as monotypic, with a single and widespread polymorphic species, *M. aethiopicum*, in eastern Africa, southern Africa, Madagascar and the Mascarenes. New combinations are made for four subspecies recognized in southern Africa, namely subspp. *aethiopicum*, *burkeanum*, *macrocarpum* and *schlechteri*.

Introduction

Mystroxylon is here treated as a genus with a single, widespread and polymorphic species that occurs throughout eastern and southern Africa, as well as Madagascar and the Mascarenes. Due to considerable variation in leaf shape, numerous names have been published (Ecklon & Zeyher 1834/5; Loesener 1942a). Robson (1965, 1966) and Robson *et al.* (1994) have already concluded that the taxon is so variable that it is impossible to recognize more than one species, namely *M. aethiopicum*.

It is nevertheless possible to recognize four distinct infraspecific forms of *C. aethiopicum* in southern Africa, on the basis of the size and shape of the leaf and fruit and mutually exclusive geographical ranges. The rank of subspecies is here applied to these forms. Three of these are well defined and restricted to southern Africa and probably also Madagascar, whereas the remaining subspecies is widespread in Africa and extremely variable. It was unfortunately not possible to finalize the complex taxonomy of the genus outside southern Africa for the purposes of this dissertation. Most type material of names proposed by Loesener and housed in Berlin was destroyed during World War II. The main question is to what extent some forms of *M. aethiopicum* described from tropical Africa are related to the southern African taxa. It is possible that some of the southern

African subspecific names may also apply to some tropical African material. The choice of subspecific rather than varietal rank should also be reviewed in the future.

It is provisionally proposed that most Tropical East African material should be classified as the variable *M. aethiopicum* subsp. *schlechteri.* Only a preliminary account of the southern African material is presented here, pending fieldwork in the rest of Africa as well as in Madagascar and the Mascarenes.

Taxonomic history

In South Africa, two species were recognized in recent years, mostly as members of an inclusive genus *Cassine,* namely *Cassine burkeana* and *C. aethiopica*. Although the genus *Mystroxylon* was recognized in most Flora accounts covering tropical Africa, the genus has usually been treated as a synonym of *Cassine s.l.* in South African herbaria. However, Loesener (1942a), Robson (1965, 1966) and Robson *et al.* (1994) advocated a more homogeneous genus, *Mystroxylon*, with three to five species. In the present study *Mystroxylon,* as defined by the latter authors, proved to be a heterogeneous taxon, resulting in two southern African taxa now being placed in the new genus *Robsonodendron. Mystroxylon s. str.* is related to *Robsonodendron*, but differs in several important morphological, palynological and anatomical characters (Archer 1990; Archer & Van Wyk 1992, 1993a, 1993b). A summary of the principal diagnostic characters for distinguishing *Mystroxylon* from *Cassine* and *Robsonodendron* are presented in Table 5. Diagnostic characters for *Mystroxylon* include the alternate leaves, pubescence, 3- or 4-locular ovary and the drupaceous fruit, usually red.

Ecklon & Zeyher (1834/5) based *Mystroxylon* on *M. filiforme* and described a further eight new species in two groups. Shortly afterwards, Harvey (1838) selected *M. filiforme* as the type of the genus. Although he certainly did not attribute the same value to a type as what was implied with the type concept nearly 100 years later, it is nevertheless to be regarded as a valid lectotypification (Greuter *et al.* (1994). Ross (1974), having studied *Thunberg herb. no. 5606*, the type of *Celastrus filiformis* L.f., the basionym of *M. filiforme,* recognized it as a species of the asclepiadaceous genus *Secamone.* Accordingly Ross proposed a new combination in *Secamone*. Art. 10. 4b of the *Code* (Greuter *et al.* 1994) states that a choice of type of a genus can be superseded only if it can be shown that the choice is in serious conflict with the protologue. Here the type specimen of *C. filiformis* has opposite leaves, while from the protologue it is clear that *Mystroxylon* is characterized by alternate leaves. *M. eucleiforme,* with *M. oligocarpum* as synonym, is considered distinct from *Mystroxylon* and the related genera in the Cassinoideae, and is here treated as a distinct new genus, *Robsonodendron.* The next six species of *Mystroxylon* described by Ecklon & Zeyher are all to be regarded as synonyms of *C. aethiopica* Thunb., a species overlooked by them. Loesener (1942a) in Die natürlichen Pflanzenfamilien selected *M. aethiopicum* as the lectotype of the genus, a choice that has been accepted by Greuter *et al.* (1993).

Taxonomy

***Mystroxylon* Eckl. & Zeyh.** Enumeratio Plantarum Africae Australis Extratropicae 1: 125 (1834/5); Loes.: 223 (1897); 176 (1942a); N. Robson: 29 (1965); 376 (1966); Troupin: 206 (1982); 330 (1983); N. Robson *et al.*: 21 (1994). Type: *M. aethiopicum* (Thunb.) Loes., designated by Loesener (1942a).

Cassine L. subg. *Mystroxylon* (Eckl. & Zeyh.) Loes.: 215 (1892); 551 (1893); 233 (1895a).

Mystroxylon Eckl. & Zeyh. sect. *Eumystroxylon* Loes.: 178 (1942a).

Evergreen, rarely deciduous, shrubs or trees; sparingly to densely pubescent, without elastic threads in bark and leaves; bark without yellow pigment, greyish to dark brown, surface smooth to longitudinally and transversely fissured; fissures often cutting deep into rhytidome. *Branchlets* terete, smooth, usually pubescent, becoming greyish brown. *Leaves* alternate, margin glandular-crenate to glandular-crenulate, crenations 10–18 on either side, coriaceous; petiole 3–8 mm long; stipules ± 1 mm long, ± triangular, pubescent, occasionally becoming glabrous, marcescent. *Inflorescences* sessile to pedunculate, composed of fasciculate cymes, axillary, 1–15-flowered; bracts minute. *Flowers* bisexual, 5-merous, ± 4 mm diam., pedicellate; pedicels 2–4 mm long. *Sepals* green, ± deltoid, with margin laciniate, equal, ± 1 mm long, pubescent. *Petals* greenish yellow, circular or depressed-ovate, ± 1.5 x 1 mm, margin entire or sparingly ciliolate, spreading. *Stamens* spreading, ± 0.7 mm long, arising from the margin of the disc with which they are united at the base; anthers ± 0.3 mm long, introrse, dehiscing by longitudinal slits. *Disc* fleshy, entire. *Ovary* ¾ immersed in and adnate to the disc, ± flush with the disc, 3- or 4-locular, with two erect collateral ovules per locule; style very short or absent, stigma inconspicuously lobed. *Fruit* a drupe, yellow-brown to bright red,

± spheroid; endocarp *s. str.* thin and crustaceous; mesocarp fleshy, the inner part often crustaceous or woody, resembling part of the endocarp. *Seed* usually single, seed-coat light brown, postchalazal vascular bundles often present; endosperm present; embryo erect, foliar.

Mystroxylon aethiopicum **(Thunb.) Loes.** in Engl. & Prantl. Natürlichen Pflanzenfamilien., Nachtr. 1: 223 (1897); 178 (1942a); Fries: 128 (1914); Burtt Davy & Hoyle: 38 (1936); H. Perr.: 36 (1946); Brenan: 129 (1953); Exell & Mendonça: 10 (1954); N. Robson: 29 (1965); 376 (1966); 338 (1989); N. Robson & Sousa: 26 (1969); Troupin: 206 (1982); 330 (1983); Jansen & Mendes: 57 (1991); Beentje: 342 (1994); N. Robson *et al.* 21 (1994). Type: Cape, *Thunberg Herb. 7429* (S!, lecto, here designated).

Cassine aethiopica Thunb.: 227 (1818); 269 (1823); Davison: 330 (1927); Steedman: 411 (1936); Keay & Blakelock: 625 (1958); Wilczek: 130 (1960); White: 216 (1962); Villiers: 12 (1975). *Elaeodendron aethiopicum* (Thunb.) Oliv. 361 (1868); Sim: 36 (1909).

Mystroxylon sphaerophyllum Eckl. & Zeyh.: 126 (1834/5); Sond.: 470 (1860). *Elaeodendron sphaerophyllum* (Eckl. & Zeyh.) Presl: 34 (1844); Ettingshausen: 53 (1857); Sim: 36 (1909). *Cassine sphaerophylla* (Eckl. & Zeyh.) Kuntze: 114 (1891); Davison: 330 (1927). Type: Cape, 'Phillipstown & Katrivier', *Ecklon & Zeyher* (S!, holo.; C!, SAM!, Z!).

Mystroxylon sphaerophyllum Eckl. & Zeyh. var. *litorale* Sond.: 470 (1860). Type: Cape, Sea shore woods at Cape Recief and Zitzekamma, *Ecklon & Zeyher* (*n.v.*).

Mystroxylon sessiliflorum Eckl. & Zeyh.: 126 (1834/5). *Elaeodendron sessiliflorum* Ettinghausen: 53 (1857). Type: Cape, 'Zwartkopsrivier, Adow & Olifantshoek', *Ecklon & Zeyher* (S!, holo.; C!, GRA!, MEL!, P!, SAM!).

Mystroxylon spilocarpum Eckl. & Zeyh.: 126 (1834/5). *Elaeodendron spilocarpum* (Eckl. & Zeyh.) Ettingshausen: 59 (1857). Type: Cape, Adow, *Ecklon & Zeyher* (SAM!, holo.; MEL!).

Mystroxylon confertiflorum Tul.: 106 (1857); Sond.: 469 (1860); Fries: 129 (1914); Loes.: 178 (1942a). Type: Madagascar, Nossi-bé, *Boivin 2168* (P, lecto., here designated).

Mystroxylon confertiflorum Tul. var. *leptocarpum* Sond.: 469 (1860). Type: Cape, Zwartkops River, *Zeyher 2201* (MEL!, lecto., here designated; Z!).

Mystroxylon pubescens Eckl. & Zeyh.: 126 (1834/5); Sond.: 470 (1860); *Elaeodendron pubescens* (Eckl. & Zeyh.) Ettingshausen: 59 (1857). *Cassine pubescens* (Eckl. & Zeyh.) Kuntze: 114 (1891); Davison: 329 (1927). *Elaeodendron aethiopicum* var. *pubescens* (Eckl. & Zeyh.) Oliv.: 361 (1868). *Mystroxylon aethiopicum* var. *pubescens* (Eckl. & Zeyh.) Brenan: 129 (1949); 238 (1953). Type: Cape, 'Zwartkopsrivier', *Ecklon & Zeyher 2200* (S!, holo.; B!, C!, GRA!, MEL!, P!, PRE!, Z!).

Mystroxylon athranthum Eckl. & Zeyh.: 126 (1834/5). *Elaeodendron athranthum* (Eckl. & Zeyh.) Ettingshausen: 59 (1857). Type: Cape, 'Zwartkopsrivier', *Ecklon & Zeyher* (S!, holo.; PRE!, TCD!).

Mystroxylon kubu Eckl. & Zeyh.: 127 (1834/5). Type: Cape, Cap Recief, *Ecklon & Zeyher* (S!, lecto., here designated).

Mystroxylon is a monotypic genus with four subspecies in southern Africa. Fruit size and colour seem to be the most reliable characters with which to construct a key to the subspecies.

Key to the subspecies

1a Fruit about 6 mm diam., yellowish brown, rarely with a reddish tinge:

  2a Leaves not discolorous, heteromorphic (leaves on young branches or coppice shoots usually large and densely pubescent); southern Cape, Eastern Cape . . . . *M. aethiopicum* subsp. *aethiopicum*

  2b Leaves conspicuously discolorous, not heteromorphic, sparingly pubescent; Gauteng, North West . . . . *M. aethiopicum* subsp. *burkeanum*

1b Fruit up to 25 mm diam., usually bright red:

3a Leaves elliptic to narrowly elliptic to obovate, usually shorter than 50 mm, usually inconspicuously pubescent, becoming glabrous; peduncle lenght usually less than 6 mm; northern KwaZulu-Natal, Mpumalanga, Northern Province, extending further north in Africa .... *M. aethiopicum* subsp. *schlechteri*

3b Leaves elliptic to widely elliptic, usually longer that 50 mm, conspicuously and densely pubescent; peduncle lenght 5–18 mm; Eastern Cape, southern KwaZulu-Natal .... *M. aethiopicum* subsp. *macrocarpum*

1. ***Mystroxylon aethiopicum*** **subsp.** ***aethiopicum***

Scrambling shrub or tree up to 10 m high. *Branchlets* usually slender. *Leaf lamina* elliptic to circular, (25–) 30–90 (–180) x (10–) 15–50 (–100) mm, greyish green, heteromorphic, base circular or cordate, apex rounded; leaves on lower branches often large and densely pubescent below, leaves on upper branches smaller and nearly glabrous. *Inflorescences* fasciculate or pedunculate, peduncle up to 18 mm long. *Fruit* pale brown, rarely with a reddish tinge, 5–7 mm diam. *Seed* 3–5 mm diam., postchalazal vascular bundles absent (Figure 23).

Occurs in the southern Cape, Eastern Cape (Figure 27) and apparently also in Madagascar. Many herbarium specimens of this species from Madagascar cannot be distinguished from the Cape specimens. It is abundant in the southern Cape forests and dune vegetation. Flowering occurs sporadically in summer.

The shape, size, and the indumentum of the leaves are very variable. Leaf dimorphism is particularly striking in this subspecies. Leaves on lower branches of young trees may be very large, up to four times the size of the adult leaves, and densely pubescent; they also tend to be much smaller and rounder in mature growth (e.g. *C. & R. Archer 2025*). In the absence of fruits subsp. *aethiopicum* may be difficult to distinguish from subsp. *macrocarpum*.

Selected specimens examined

—**3128** (Umtata): Shawbury, Tsitsa River (–BB), *Van Wyk 3261* (PRU).

—**3129** (Port St Johns): 14.5 mile SE of old Bunting on Umgazana rd (–CB), *Marais 767* (BOL, GRA, MO, PRE).

—**3226** (Fort Beaufort): Bedford Catchment, SE of main road (–CC), *Hobson 1135* (GRA); Port Alfred (–DB), *Gibbs Russell 3894* (GRA, PRE); Alice, Tukulu-Woodstock farms (–DD), *Phillipson 1112* (MO, PRE).

—**3227** (Stutterheim): 3 mile NW of Keiskammahoek (–CA), *Story 3677* (GRA, PRE); Izeleni Forest (–CD), *Osborne 44* (GRA); Middledrift, Farm Fort Cox (–CC), *Brickhill* (PRE); Toise River (–DA), *Marais 520* (GRA, PRE); Kei Bridge (–DB), *Marais 467* (BOL, GRA, PRE); Nahoon River Mouth (–DD), *Marais 459* (BOL, GRA, PRE); Bonza Bay (–DD), *Marais 731* (GRA, PRE).

—**3228** (Butterworth): Cefane River (–CC), *O'Callaghan 986* (GRA); *1010* (GRA); *1021* (GRA); Nxaxo River, Wavecrest (–DA), *Lubke* (GRA).

—**3322** (Oudtshoorn): George, Groenkop Forest Reserve (–CD), *Archer 287* (PRU); Ebb and Flow Nature Reserve (–DC), *Taylor 7981* (PRE).

—**3323** (Willowmore): Keurbooms River, Farm Tsokwane (–CD), *Von Teichman 344* (PRE, PRU).

—**3324** (Steytlerville): Port Elizabeth, Hankey (–DD), *Paterson 18* (Z).

—**3325** (Port Elizabeth): Kirkwood, farm Eugenia (–AD), *De Winter 7609* (B, PRE); Coerney River, Zuurberg (–AD), *Archibald 5548* (GRA, PRE); Alexandria, Farm Melkhoutboom (–BB), *Scharf 1752* (NBG); Zuurberg National Park, circle route (–BC), *Archer 301* (PRU); Alexandria, Hillary near Sandflats (–BD), *Burtt Davy 14281* (BOL, PRE); Tatoobi Nature Reserve (–BD), *Jennings s.n.* (GRA); Alexander Fountain (–CB), *Marais 538* (BOL, GRA, PRE); Alexandria Forest (–CB), *Marais 406* (BOL, PRE); Loerie Hills S of the Village on old road to Devonia (–CC), *Bean 861* (BOL); Longmore Forest Reserve (–CC), *Marais 723* (GRA, PRE); Uitenhage, Springs Nature Reserve (–CD), *Olivier 2633* (GRA); Swartkops River (–DA), *O'Callaghan 1130* (GRA); Sundays River (–DB), *O'Callaghan 1106* (GRA); Markman Industrial Area (–DC), *Dahlstrand 2848* (GRA, MO, PRE); Target Kloof, Baakens River (–DC), *Olivier 1055* (NBG).

—**3326** (Grahamstown): Piggott's Bridge, Farm Hounslow (–AB), *Bayliss 8912* (B, GRA, MO); Shamwari Game Reserve Park (–AC), *Palmer 2548* (GRA); Gameston (–AD), Story 2631 (GRA, PRE); Andries Vosloo Kudu Reserve (–BA), *Palmer 122* (GRA); Ecca Pass (–BC), *Bayliss BRI 758* (PRE, Z); Bloukrantz Nature Reserve

(–BC), *Lloyd 106* (GRA); Kariega River, 2 mile from Mouth (–DA), *Story 3249* (GRA, PRE); 3247 (GRA, PRE); Kenton On Sea (–DA), *Jubb* (GRA, PRE); Boknesstrand (–DA), *Burrows 2824* (GRA); Port Alfred, E bank (–DB), *Gibbs Russell 3894* (PRE).

—**3327** (Peddie): Tharfield Farm, between Riet and Kleinemond Rivers (–CA), *Lubke 2366* (GRA).

—**3421**(Riversdale): Heidelberg, near Puntjie (–AC), *Esterhuysen 28764* (BOL, K); Still Bay, hills (–AD), *Bohnen 5093* (MO, PRE, STE); Albertinia, Ystervarkfontein (–BD), *Bayliss BRI 6250* (PRE).

—**3422** (Mossel Bay): Holiday Inn Plot, W of Hoekwil Road (–BA), *Jacot Guillarmod 8152* (GRA); 17 mile W of Knysna (–BB), *Marais 703* (GRA, PRE).

—**3423** (Knysna): Harkerville Forestry Reserve (–AA), *Botha 3037* (PRE); Plettenberg Bay, Robberg Hiking Trail (–AB), *Archer & Archer 2025* (PRE, PRU); Keurboom Strand (–AB), *Taylor 2911* (BOL).

—**3424** (Humansdorp): Near Kleinplaas (–AB), *Cowling 1505* (GRA); Kloof 14 mile W of Humansdorp (–BA), *Marais 572* (BOL, GRA, PRE).

—**3425** (Skoenmakerskop): Cape Recife (–BA), *Olivier 3021* (GRA).

2. ***Mystroxylon aethiopicum* subsp. *burkeanum* (Sond.) R.H. Archer**, stat. nov. Type: Transvaal, banks of the Crocodile River, *Zeyher 309* (S!, lecto., here designated; BM!, MEL!, P!, PRE!, TCD!).

Mystroxylon burkeanum Sond. in Harv. & Sond, Flora Capensis 1: 470 (1860). *Cassine burkeana* (Sond.) Kuntze: 114 (1891); Davison: 329 (1927); Burtt Davy: 450 (1932); Hutch.: 668 (1946); Van Gogh & Anderson: 58 (1988).

Elaeodendron ? *rehmanniii* Szyszyl.: 37 (1888). Type: Transvaal, Aapies Poort, *Rehmann 4099* (BM!, K!, Z [7099]!)

Icones: Van Gogh & Anderson: 59 (1988).

Much-branched shrub or small tree up to 8 m high. *Branchlets* stout, often with short, thick branchlets at right angles on main shoots. *Leaf lamina* elliptic to ovate, conspicuously discolourous, dark green above, pale green below, (10–) 15–25 (–50) x (5–) 8–15 (–20) mm, base rounded, apex rounded, sparingly pubescent or glabrous. *Inflorescences* fasciculate or pedicellate, peduncle up to 5 mm long. *Fruit* pale brown or yellowish, rarely with a reddish tinge, 5–8 mm diam. *Seed* 4–5 mm diam., postchalazal vascular bundles usually present (Figure 24).

Occurs around Pretoria and Witwatersrand in Gauteng and to the west in North-West Province (Figure 28). The distribution of subsp. *burkeanum* does not overlap with that of subsp. *schlechteri*. Leaves distinctly discolorous, with branches thick and stout. A gall mite (order Acarina) is common on the leaves, causing characteristic brown, hairlike galls. Similar galls are less frequently encountered in the other subspecies.

Selected specimens examined

—**2526** (Zeerust): Swartruggens (–DA); *Sutton 1142* (PRE).
—**2527** (Rustenburg): Rustenburg Nature Reserve (–CA), *Jacobson 1706* (PRE); Buffelspoort, Omaramba ATKB Resort (–CD), *Van Wyk 6941* (PRE, PRU); Selikaatsnek (–DB), *Smuts 1410* (BOL, PRE); Hekpoort (–DC), *Phillips 506* (PRE); Hartebeespoort (–DD), *Hutchinson 2330* (BOL, K, PRE).
—**2528** (Pretoria): Farm Middelkop near Pienaar's River (–AB), *Smith 2211* (PRE); Wonderboompoort (–CA), *Mogg 14759* (PRE); Roodeplaatdam Nature Reserve (–CB), *Van Rooyen 2228* (PRE, PRU); Fountains Valley (–CC), *Verdoorn 582* (PRE); Faerie Glen Nature Reserve (–CD), *Archer 204* (PRE).
—**2529** (Witbank): Loskop Dam, Lombards Bay (–AD), *Theron 2679* (PRE, PRU).
—**2627** (Potchefstroom): Witwatersrand National Botanic Garden, Poortview (–BB), *Behr 830* (PRE); Potchefstroom, Dassiesrand (–CA), *Van Wyk 428* (PRE, PRU).
—**2628** (Johannesburg): Braamfontein (–AA), *Gillfillan 172* (PRE); Suikerbosrand, Blesboklaagte (–CA), *Bredenkamp 447* (PRU); Suikerbosrand, Tierkloof (–CB), *Bredenkamp 512* (PRU).
—**2727** (Kroonstad): Vredefort (–AB), *Pole-Evans PRE 19473* (PRE).

3. ***Mystroxylon aethiopicum* subsp. *macrocarpum* (Sond.) R.H. Archer**, stat. nov. Type: Eastern Cape, between Omtata [Umtata] and Omsamwubo [Mzimvubu], *Drège 5612* (S!, holo.).

Mystroxylon macrocarpum Sond. in Harv. & Sond. Flora Capensis 1: 471 (1860).

Elaeodendron velutinum Harv.: 55 (1863). *Cassine velutina* (Harv.) Pegler ex Davison: 328 (1927). *Cassine sphaerophylla* (Eckl. & Zeyh.) Kuntze var. *velutina*

(Harv.) Von Breitenbach: 634 (1965). Type: KwaZulu-Natal, Nonoti River, *Gerrard & McKen 1381* (TCD!, holo.; BM!).

Scrambling shrub or tree up to 5 m high. *Branchlets* usually slender. *Leaf lamina* elliptic to widely elliptic, pale green, (50–) 60–90 (–180) x (25–) 35–70 (–100) mm, base rounded to occasionally cordate, apex rounded, usually densely pubescent. *Inflorescences* pedunculate, peduncle 5–20 mm long. *Fruit* bright red, 15–20 mm diam. *Seed* 5–7 mm diam., postchalazal vascular bundles usually present (Figure 25).

Restricted to central and southern KwaZulu-Natal and the Pondoland region (Eastern Cape), where it occurs in riverine forest fringes and forests (Figure 29). Distinguished from subsp. *aethiopica* by its larger fruit and absence of leaf dimorphism, and from subsp. *schlechteri* by its larger, often densely pubescent leaves. Sterile material may be difficult to distinguish from large juvenile-leaved specimens of the typical subspecies. Indications are that subsp. *macrocarpum* intergrades with subspp. *schlechteri* and *aethiopicum* in areas where their distributions overlap in southern KwaZulu-Natal and Eastern Cape. Subsp. *macrocarpum* displays characters of both subsp. *schlechteri* and subsp. *aethiopicum.* Considering its large hairy leaves (reminiscent of juvenile leaves in the other two subspecies) this taxon may have originated through neoteny from either subspecies.

The name *Cassine velutina* has often been applied to herbarium material of the present subspecies as well as some large-leaved forms of subsp. *aethiopicum.* The earlier epithet *macrocarpum* is appropriate as it emphasizes the larger fruit size.

Selected specimens examined

—**2930** (Pietermaritzburg): 8 km S of Wartburg, Farm Windy Hill 19420 (–DA), *Balkwill & Balkwill 4705* (J, MO, PRU); Inanda, Kloof (–DB), *Strey 10563* (PRE); Camperdown, Shongweni Dam (–DC), *Morris 728* (PRE).

—**2931** (Stanger): Harold Johnson Nature Reserve (–AB), *Nichols 858* (NH, PRE); Newark, 15 mile N of Stanger (–AB), *Edwards 2832* (PRE).

—**3030** (Port Shepstone): 5 km from Adam's Mission to Umbumbulu (–BB), *Venter 1044* (MO, P RE); Amanzimtoti, Illanda Wilds Nature Reserve (–BB), *Schrire 1402* (NH, PRE); Umdoni Park, Umzinto (–BC), *Cooper 127* (NH, PRE); Mzimkulu River Valley, Gibraltar Rock (–CB), *Van Wyk 10469* (PRU); Port Edward, Beacon Hill

(–CC), *Van Wyk 5327* (PRE, PRU); 5 mile NW of Uvongo (–CD), *Moll 4936* (PRE, S).

—**3129** (Port St Johns): Lusikisiki, Mlambankulu River, below Isicezula Forest (–BD), *Van Wyk & Mathews 7744* (PRE, PRU).

—**3130**(Port Edward): Enganyama River Gorge, tributary of Mzamba River (–AA), *Van Wyk 8101* (PRU).

—**3228** (Butterworth): Kentani (–AD), *Pegler 713* (BM, BOL, PRE); 2 mile S of Kentani (–AD), *Story 4037* (GRA).

4. ***Mystroxylon aethiopicum* subsp. *schlechteri* (Loes.) R.H. Archer** stat. nov.

Mystroxylon schlechteri Loes.: 159 (1900). *Cassine schlechteri* (Loes.) Davison: 329 (1927); Type: Delagoa-Bai, Ressano Garcia, *Schlechter 11944* (B†, holo.; BM!, BOL!, MO!, PRE!, S!, Z!).

Cassine holstii Loes.: 233 (1895a). *Mystroxylon holstii* (Loes.) Loes.: 223 (1897); 159 (1900).Type: Sansibarküste, Doda, *Holst 2960* (B†, holo.; P!).

Mystroxylon goetzei Loes.: 158 (1900). Syntypes: Uluguru, Station Ug'lewénu, Rodungsgebiet, *Stuhmann 8839* (B†); Lukwangul-Plateau, *Götze 314* (B†).

Mystroxylon ussanguense Loes.: 345 (1901). Syntypes: Nördl. Kingagebirge, Ussangu, *Goetze 1002* (B†, P!); *1274* (B†, P!).

Cassine engleriana Loes.: 552 (1893). *Mystroxylon englerianum* (Loes.) Loes.: 223 (1897). Type: Sansibar, Kokotoni, *Stuhlmann ser.1. 582* (B†, holo.).

Cassine aethiopica Thunb. var. *burkeana* (Sond.) Loes.: 552 (1892); *Mystroxylon aethiopicum* (Thunb.) Loes. var. *burkeanum* (Sond.) Loes.: 159 (1900); Fries: 128 (1914); Loes.: 491 (1934); *non M. burkeanum* Sond.: 470 (1860).

Mystroxylon aethiopicum (Thunb.) Loes. var. *burkeanum* (Sond.) Loes. forma *subintegrum* Loes.: 159 (1900). Type: Angola, Huila, *Antunes 107* (B†).

Mystroxylon aethiopicum (Thunb.) Loes. var. *burkeanum* (Sond.) Loes. forma *ovato-elliptica* Loes.: 491 (1934). Syntypes: West-Kenia, Bei forest Station, *Fries & Fries 617* (B†); *909* (B†, UPS!).

Cassine confertiflora (Tul.) Loes.: 553 (1893) *pro parte*, *non* Sond.

Cassine aethiopica sensu Loes.: 552 (1893).

Mystroxylon nyasicum Dunkley in Burtt Davy & Hoyle: 37 (1936), *nom. nud.*

Elaeodendron velutinum sensu Burtt Davy & Hoyle: 37 (1936).

Cassine aethiopica auct. non Thunb.: Compton: 337 (1976).

Icones: Jansen & Mendes: 55 t. 100 (1991).

Shrub or small tree up to 15 m high. *Branchlets* usually slender. *Leaf lamina* elliptic, narrowly elliptic to obovate, pale green or pale grey, (25–) 40–70 (–100) x (8–) 15–30 (–50) mm, base attenuate, apex rounded or acute, young leaves pubescent, becoming glabrous. *Inflorescences* pedunculate, peduncle 2–6 (–18) mm long. *Fruit* bright red when ripe, 15–25 mm diam.; usually with sclerified mesocarp. *Seed* 5–7 mm diam., postchalazal vascular bundles usually present (Figure 26).

Widespread in the eastern parts of southern Africa and extending northwards to tropical eastern Africa (Figure 30). Subsp. *schlechteri* is used here in a much wider sense than Loesener's (1900) original application to a narrow-leaved form. Flowering sporadically in spring and fruit ripen over a nine-months period. Fruit is sometimes sweet and edible.

Selected southern African specimens examined

Swaziland

—**2531** (Komatipoort): Tsaneni (–DC), *Barrett 27* (PRE).
—**2631** (Mbabane): Timbutini (–AD), *Compton 30744* (NBG, PRE); Balegane (–BA), *Nel 138* (NBG, PRE); 1 km NW of top of Lubombo Mountains (–BD), *Culverwell*

168 (PRE); Mkhondo/Assegaai River, 16 km S of Sidvokodvo (–CB), *Prior 129* (PRE); Hlatikulu, Grand Valley Hills (–CD), *Dlamini NBG 32789* (NBG, PRE); Lubombo, Kupileni (–DA), *Kemp 831* (PRE).

—**2632** (Bela Vista): Ndzindza Nature Reserve, Umbuluzi Gorge (–AA), *Culverwell 1278* (PRE).

South Africa

—**2229** (Waterpoort): Saltpan, N of Soutpansberg (–CD), *Schlieben 7411* (B, Z); Vivo, Lesheba Wilderness, Farm Bangor 755 MS (–DC), *Archer 379* (PRU); Wyliespoort (–DD), *Van Graan & Hardy 502* (MO, PRE).

—**2230** (Messina): Venda, Gogogo (–CD), *Van Wyk & Theron 4896* (PRE, PRU); Venda, Muledzhi, Vuvha (–DA), *Van Wyk 5612* (PRU).

—**2231** (Pafuri): Kruger National Park, Sandveld N[E?] of Punda Milia (–CB), *Bredenkamp 1936* (PRE).

—**2328** (Baltimore): Blaauwberg, Farm Leipzig 264 LR (–BB), *Venter 6154* (PRE).

—**2329** (Pietersburg): Blouberg Nature Reserve (–AA), *Klopper 60A* (PRE, PRU); Ben Lavin Nature Reserve (–BB), *Burger 522* (PRE); 0.8 km N of Bandelierskop (–BD), *Van Wyk 5707* (PRE, PRU); Boyne, Molepo Nature Reserve (–CD), *Gerstner 5383* (PRE); Pietersburg, 10 km to Tzaneen, granite dome (–DC), *Archer 334* (PRU).

—**2330** (Tzaneen): Modjadji's Nature Reserve (–CA), *Krige 116* (PRE); 5 mile WSW of Leydsdorp (–DC), *Acocks 12899* (PRE).

—**2428** (Nylstroom): Vaalwater, Farm Kgama (–AB), *Archer 328* (PRE); Geelhoutkop (–AD), *Mogg 24440* (PRE); Naboomspruit, Farm Stepping Stones (–BA), *Mogg 37309A* (PRE); Sterkrivier Dam Nature Reserve (–BC), *Jacobsen 1983* (PRE).

—**2430** (Pilgrim's Rest): Upper Hohlapitse River Valley, W of The Downs (–AA), *Burrows 3506* (J, MO); Erasmus Pass (–BC), *Strey3799* (BM, PRE); Swadini, National Walking Trail (–BD), *Van Greuning 521* (PRE, PRU); 7 km NE of Steelpoort (–CA), *Reid 701* (PRE); 3 mile N of Ohrigstad (–DA), *Young A543* (PRE); Blyde River Poort (–DB), *Van Greuning 294* (PRE, PRU); Blyde Canyon, Kadishi Valley (–DD), *Onderstall 253* (PRE).

—**2431** (Acornhoek): Phalaborwa, Farm Sheila 10 KU (–AA), *Retief 169* (PRE); Klaserie, Farm Guernsey (–AC), *Burger 30* (PRE); Timbavati Private Nature Reserve, Farm Hermansberg 77 KU (–CC), *Zambatis 1723* (PRE); Manyeleti Game Reserve (–DA), *Bredenkamp 1199* (PRU); Kruger National Park, Skukuza, Muthlumuvi Stream (–DC), *Van Greuning 548* (PRE, PRU).

—**2531** (Komatipoort): Kruger National Park, Numbi (–AA), *Van der Schijff 60* (PRE); Kruger National Park, Malelane Rest Camp (–AD), *Codd 4361* (PRE); Barberton, Louw's Creek (–CA), *Wager TRV 22415* (PRE); Barberton, Farm Three Sisters (–CB), *Balkwill & Balkwill 4459* (J, PRE, PRU).

—**2532** (Maputo): Lebombo Mountains, between Komatipoort & Squamans, Farm Avondstonde (–CA), *Coetzee 1384* (MO, PRE).

—**2632** (Bella Vista): Near Ndumu Game Reserve, Mahemane Bush (–CC), *Moll 4373* (PRE); 1 mile E of Makane's Pont (–CD), *Ross 1955* (PRE); Dunes N of Kosi Mouth (–DD), *Stephen & Van Graan 1288* (PRE).

—**2731** (Louwsburg): 3 mile NW of Ingwavuma (–BB), *Codd 2078* (P, PRE); 2 mile SW of Magut (–DA), *Acocks 13029* (PRE).

—**2732** (Ubombo): Corridor between Nduma & Tembe (–AB), *Van Wyk BSA 682* (PRU); Kosi Bay Coastal Forest Reserve, Rocktail Bay (–BB), *Matthews 1043* (PRE, PRU); Lake Sibaya (–BC), *Tinley 128* (PRE); Mkuze Game Reserve (–CA), *Ward 22* (PRE).

—**2831** (Nkandla): Umfolozi Game Reserve, Ngoloti (–BD), *Ross 2030* (PRE); Umhlatuzana Hills (–DD), *Venter 4042* (PRE).

—**2832** (Mtubatuba): Hluhluwe Game Reserve (–AA), *Balkwill et al. 1722* (NU, PRE, S); False Bay (–AB), *Bayer 1482* (PRE); Dukuduku State Forest (–AC), *Nicholas 1357* (MO, PRE); Eastern Shores State Forest (–BA), *Phillipson 3302* (GRA); Richard Bay Mzingazi (–CC), *Venter 5856* (PRU).

—**2930** (Pietermaritzburg): Albert Falls Dam (–AD), *Nichols 864* (PRE); Ixopo, 20 mile from Highflats on road to Richmond (–CD), *Marais 794* (GRA, PRE); Krantzkloof Nature Reserve (–DD), *Moll 3317* (PRE).

Species excluded.

Mystroxylon comorense (Loes.) Loes.: 223 (1897). = *Euclea* sp.
Mystroxylon reticulatum (Eckl. & Zeyh.) Dietr.: 817 (1839). = *Lauridia* Eckl. & Zeyh.

Figure 23. *Mystroxylon aethiopicum* subsp. *aethiopicum*. Flowering branch. *Von Teichman 344* (PRE)

Figure 24. *Mystroxylon aethiopicum* subsp. *burkeanum*. Fruiting branch. *Van der Meulen 1118* (PRE).

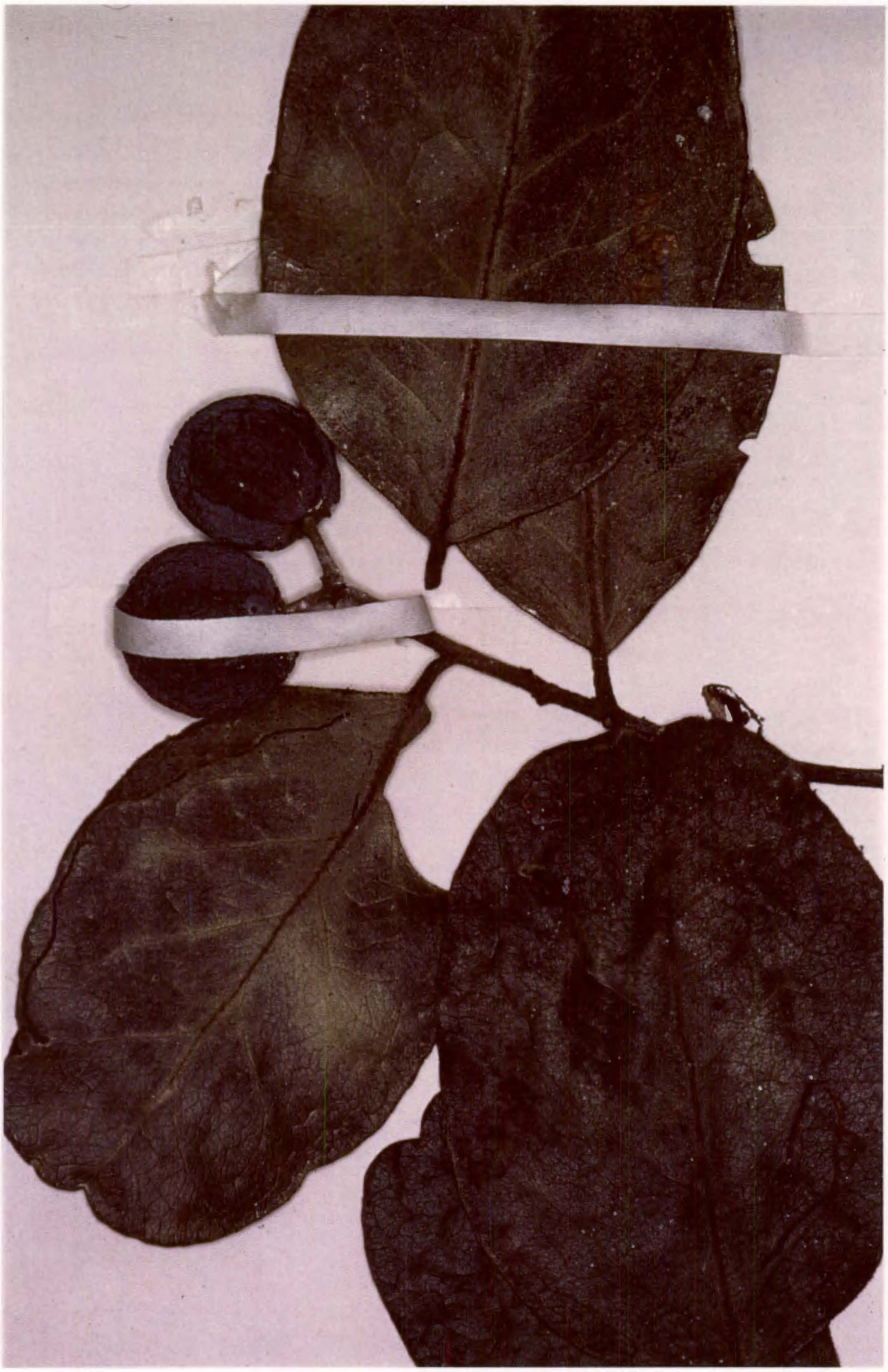
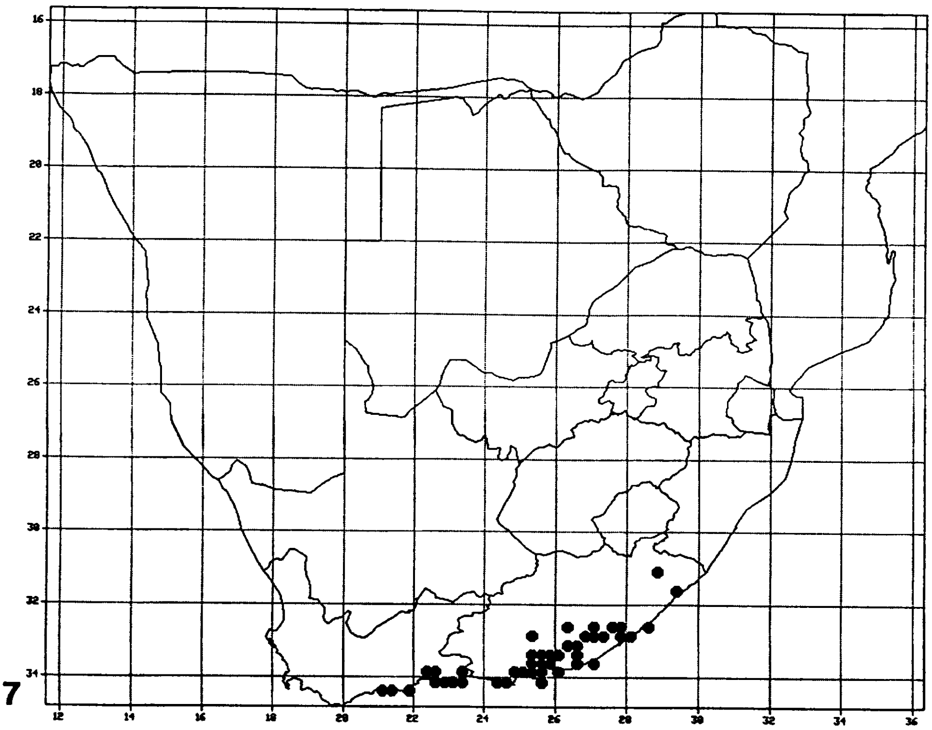
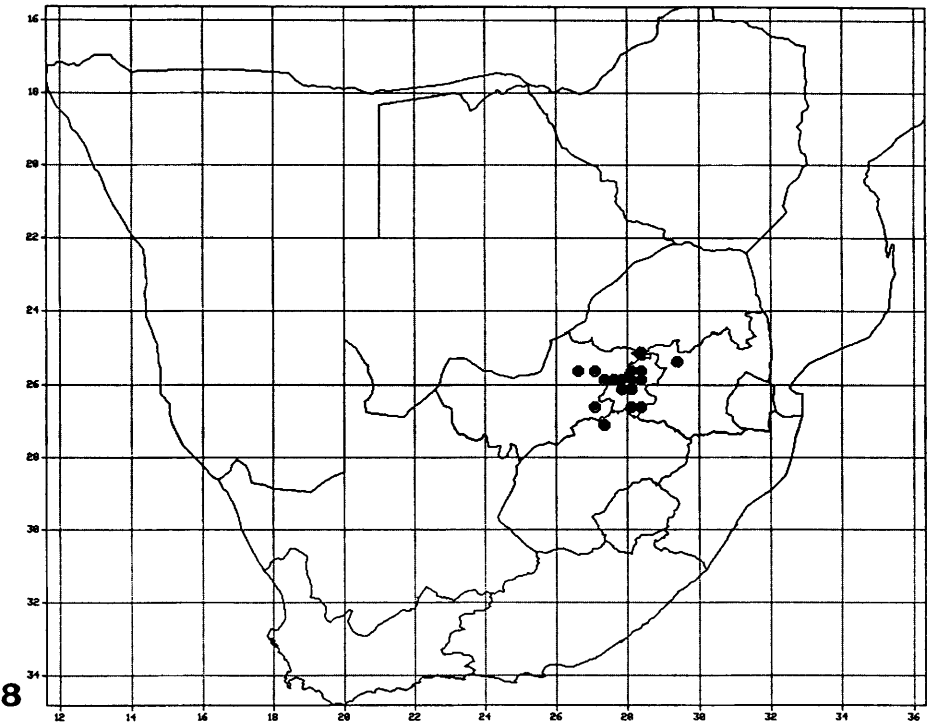


Figure 25. *Mystroxylon aethiopicum* subsp. *macrocarpum*. Fruiting branch. *Jordaan 324* (PRE).

Figure 26. *Mystroxylon aethiopicum* subsp. *schlechteri.* Portions of flowering and fruiting branches. *Archer s.n.* (PRE).



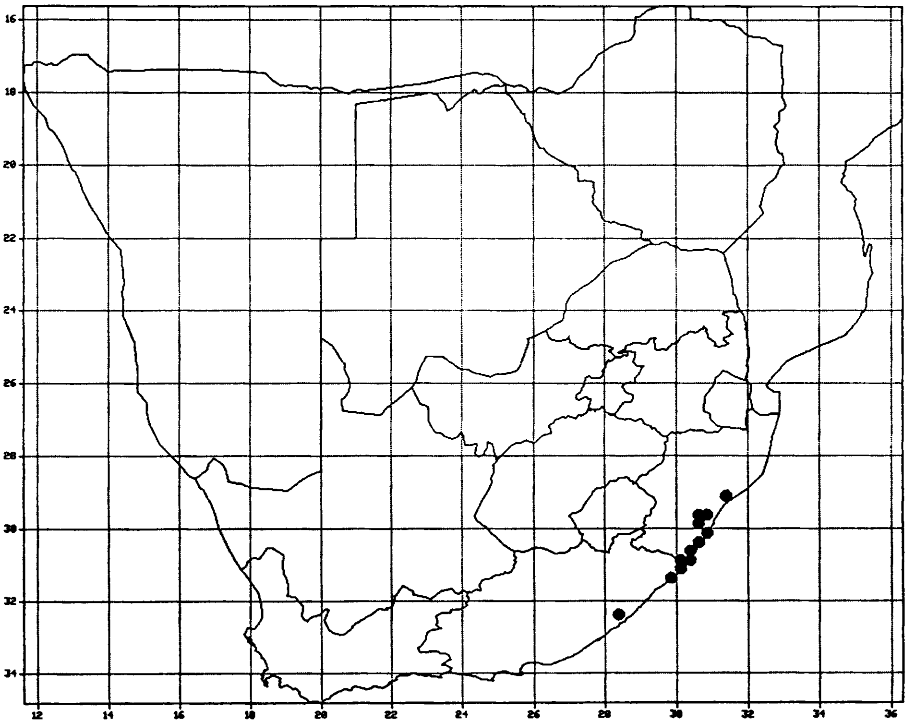
27



28

Figure 27 & 28. Known distribution of *Mystroxylon* in southern Africa. **27.** *M. aethiopicum* subsp. *aethiopicum*. **28.** *M. aethiopicum* subsp. *burkeanum*.

29



30

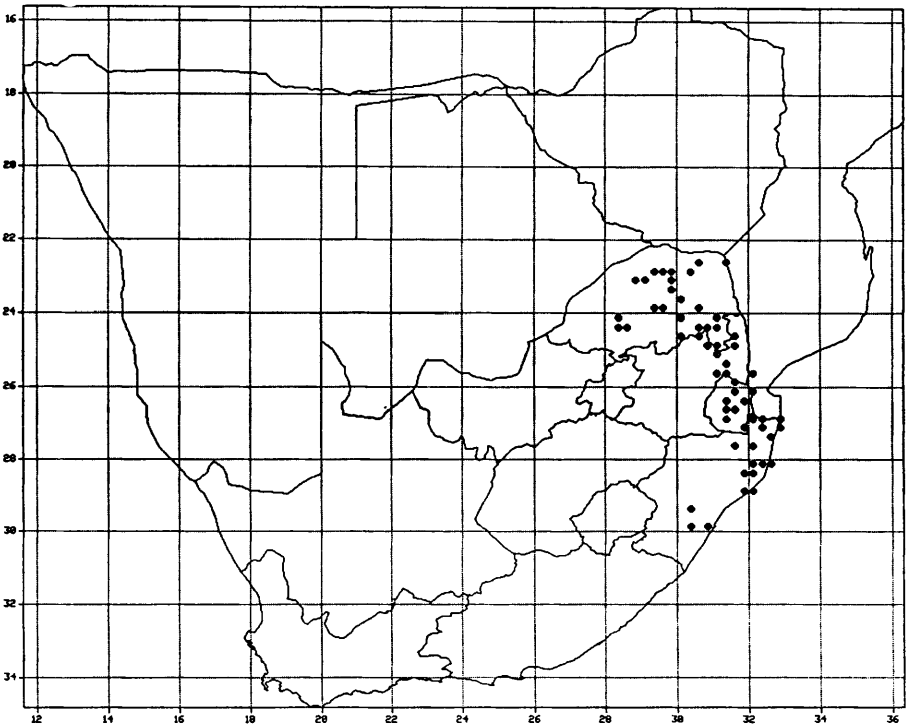


Figure 29 & 30. Known distribution of *Mystroxylon* in southern Africa. **29.** *M. aethiopicum* subsp. *macrocarpum*. **30.** *M. aethiopicum* subsp. *schlechteri*.

5.7 *ELAEODENDRON* JACQ.[*]

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[*] To be submitted to *Kew Bulletin*. Specimens have been cited for all quarter degree grids in the present version.

A taxonomic revision of *Elaeodendron* Jacq. (Celastraceae) in Africa

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The heterogeneous genus, *Cassine* L. *s.l.* is subdivided into smaller, more natural units, following new evidence from palynology, macromorphology and anatomy. The re-evalued cosmopolitan genus *Elaeodendron* Jacq., here recognized, consists of 30 to 40 species of shrubs and trees distributed in Africa, Asia, Australasia and central America. A taxonomic revision of the eight African species of *Elaeodendron* Jacq. (Cassinoideae: Celastraceae) is presented. The new combination *E. transvaalense* is made. The correct application of previously misapplied or confused names is discussed.

Introduction

This paper emanates from a multidisciplinary study towards a taxonomic revision of the southern African Cassinoideae (Archer & Van Wyk in press). It has long been a matter of dispute whether to treat *Cassine* L. in a wide sense (e.g. Ding Hou 1962, Kostermans, 1986), or to recognize a number of segregate genera, including *Elaeodendron* Jacq. (e.g. Loesener in Die natürlichen Pflanzenfamilien, 1942a). Following Archer (1990) and Archer & Van Wyk (1992, 1993a, 1993b, in press a), five distinct southern African genera, the African/Madagascar *Mystroxylon* and the cosmopolitan *Elaeodendron*, can be conclusively recognized on evidence from palynology, macromorphology and anatomy. The present concept of *Cassine s. str.* largely follows Loesener (1942a), Robson (1965, 1966, 1989) and Robson *et al.* (1994) and necessitates many name changes back to the original basionyms in *Elaeodendron* for most species of *Cassine s.l.* from other parts of the world. Fortunately, most species have been well known under *Elaeodendron,* and in most cases correct combinations already exist. Approximately 40 species of *Elaeodendron* can be recognized from central America, Africa and Australasia. Eight taxa are confined to Africa, excluding the Mascarenes and Madagascar, and are here revised. One species, *Elaeodendron orientale,* which was treated as a cultivated species in Flora Zambesiaca (Robson 1966), seems to exist in that Flora area as a single tree in the Mutare Botanical Garden, Zimbabwe. A synopsis of the known species of *Elaeodendron* worldwide is in preparation.

Systematic treatment

***Elaeodendron* Jacq.** Icones Plantarum Rariorum t. 48 (1782); Murray: 241 (1784), as *Elaeodendrum*; Jacq. f.: 36 (1787), as *Elaeodendri*; Loes.: 223 (1897); 172 (1942a); Thonner: 331 (1915); N. Robson: 385 (1966); N. Robson *et al.*: 29 (1994). Type: *E. orientale* Jacq.

Rubentia Juss.: 378, 452 (1789); Gmel.: 408 (1791). Type: *R. olivina* J.F. Gmel. (*Elaeodendron orientale* Jacq.).

Schrebera Retz.: 25 (1791) *non* L. *nec* Schreb., *nec* Roxb. Type: *S. albens* Retz.

Portenschlagia Tratt.: 250 (1818). Type: *P. australis Tratt.*

Neerija Roxb.: 86 (1814); Carey et Wallich in Roxb.: 444 (1824); Carey in Roxb.: 646 (1832). Type: *N. dichotoma* Roxb.

Crocoxylon Eckl. & Zeyh., 128 (1834/5); Harv.: 50 (1838); N. Robson: 40 (1965); 390 (1966); N. Robson & Sousa: 36 (1969). Type: *C. excelsum* Eckl. & Zeyh. *nom. illeg.* (*Elaeodendron croceum* (Thunb.) DC.).

Cassine Loes.: 214 (1892), *pro parte* excl. typum; Davison 2: 326 (1927) *pro parte*; *sensu auct. plur.*, *non* L. Type: *C. peragua* L. *type prop. cons.*

Cassine L. sect. *Euelaeodendron* Loes.: 215 (1892).

Telemachia Urb.: 334 (1916). Type: *T. trinitensis* Urb. (*Elaeodendron australe* Vent.).

Pseudocassine Bredell: 330 (1937); Compton: 338 (1976). Type: *P. transvaalensis* (Burtt Davy) Bredell.

Shrubs to tall evergreen trees; unarmed, glabrous, without elastic threads in bark and leaves; bark with layers of yellow pigment occasionally present or hardly discernible. *Branchlets* subangular to terete, lenticels usually prominent. *Leaves* opposite to subopposite, or occasionally alternate, spiralled to fasciculate; stipules minute, ± 1 mm long, ± triangular, marcescent. *Inflorescences* usually pedunculate, dichasial. *Flowers* usually bisexual or occasionally unisexual, sometimes with petaloid staminodes in female flowers; 3-, 4- or 5-merous (except ovary), pedicellate. *Sepals* equal, subcircular. *Petals* cream to greenish, oblong to ovate, entire or with ventral projections, spreading. *Stamens* erect to spreading; arising inside margin of disc or from sinuses in the margin of the disc, anthers introrse or extrorse, dehiscing by longitudinal slits. *Disc* entire to subentire and convex, fleshy, or flat and quadrangular, with sinuses at the point of stamen insertion, flat to concave. *Ovary* ± ½ immersed in and adnate to the disc, 2-, 3- or 4-locular, with two erect collateral ovules per locule; style short to astylous, stigma inconspicuous. *Fruit* drupaceous, spheroid to ellipsoid, white to yellow; stone narrowly elliptic to elliptic, surface smooth or with grooves. *Seeds* brownish, narrowly ellipsoid, ovoid, flattened to triangular, postchalazal vascular bundles often present, endosperm present; embryo erect with cotyledons fleshy, elliptic or ovate.

Elaeodendron is one of the largest genera in the Celastraceae, consisting mostly of shrubs or trees. Aproximately 30 to 40 species can be recognized in central America, Africa, Asia and Australasia. Some species in the genus are commercially exploited or have potential for wood production.

The African species of *Elaeodendron* are more frequent in southern Africa and the eastern lowland parts of the continent. Three species, *E. buchananii*, *E. matabelicum* and *E. transvaalense,* also extend to the drier parts of western tropical Africa.

Much uncertainty exists in recent literature concerning the correct spelling and author citation of the name *Elaeodendron* (Archer & Van Wyk in press b). Kostermans pointed out that *Elaeodendrum* Murray has priority over *Elaeodendron* Jacq. f., while most authors considered either Jacq. f. or Jacq. to be the correct author of the generic name. Archer & Van Wyk (in press b) argue that *Elaeodendron* Jacq. (1782) is validly published as a plate with an analysis and that it predates both Murray (1784) and Jacquin f. (1787).

Robson (1965, 1966) treated *E. zeyheri* (*Cassine crocea auct. non* Thunb.) and *E. transvaalense* under the genus *Crocoxylon*. This division is supported by a distinctive pollen type with a rugulose-reticulate exine structure (Archer & Van Wyk 1992). However, several tropical African and extra-African species are intermediate (in pollen structure and flower morphology) between *Elaeodendron* and Robson's concept of *Crocoxylon*. The key provided below gives some indication of the considerable variation in floral parts in the African species of *Elaeodendron*. At this stage it is not feasible to recognize a segregate genus or even any supraspecific ranks. Incidentally, *Crocoxylon* is to be regarded as a synonym of *Elaeodendron*, typified by *E. croceum* (Thunb.) DC. (not *Crocoxylon crocea* (Thunb.) N. Robson).

Key to the African species of *Elaeodendron*

1a Flowers with ovary heteromerous with other floral whorls, 2- or 3-locular:

2a Flowers 4-merous, ovary 2-locular:

3a Tree; leaf margin denticulate to prominent spinulose on juvenile shoots; fruit large, up to 32 x 15 mm, cream; southern Africa .... 1. *E. croceum*

3b Shrub or small tree (usually less than 3 m high); leaf margin entire or rarely spinulose-denticulate; fruit small, 8 x 5 mm, greenish?; coast of east Africa .... 2. *E. schweinfurthianum*

2b Flowers 5-merous, ovary 2- or 3-locular:

4a Shrub or small irregular tree; leaf margin prominently spinulose; ovary 2-locular; Somalia, Kenya .... 3. *E. aquifolium*

4b Tree; leaves serrate or glandular-crenulate, occasionally spinulose; ovary 2- or 3-locular:

5a Flowers unisexual; ovary 2- or 3-locular; staminodes petaloid .... 4. *E. buchananii*

5b Flowers bisexual (rarely unisexual, then staminodes stamen-like); ovary 3-locular:

6a Leaf margin spinulose-denticulate, occasional subentire; lamina glossy greyish-green; southern tropical Africa and east Africa . . . . 5. *E. schlechterianum*

6b Leaf margin glandular-crenate; lamina pale yellowish green; southern tropical Africa . . . . 6. *E. matabelicum*

1b Flowers with ovary isomerous with other floral whorls, 3- or 4- locular

7a Flowers 4-merous; Eastern Cape & KwaZulu-Natal, rare in Mozambique and Northern Province . . . . 7. *E. zeyheri*

7b Flowers 3-merous; widespread in southern Africa . . . . 8. *E. transvaalense*

1. Elaeodendron croceum (Thunb.) DC. Prodromus 2: 11 (1825)[as *Elaeodendron?*]; Pappe: 10 (1854); Sond.: 468 (1860) *pro parte*; Marloth: 154 (1925); Archer: 58 (1995) . Type: *Thunberg*, sheet 3807 in Herb. Thunb. (UPS!, holo).

Ilex crocea Thunb.: 32 (1794a); 1: 169; 2: 109 (1794b [original version, 1788]); Thunb.: 577 (1818); 159 (1823). *Cassine crocea* (Thunb.) Kuntze: 114 (1891); von Breitenbach: 637 (1965), *pro parte*; Coates Palgrave: 510 (1977) *pro parte*; *non* Davison: 334 (1927).

Elaeodendron capense Eckl. & Zeyh.: 127 (1834/5); Graham: 3835 (1841); Sond.: 468 (1860); Bak. f.: 45 (1911); Eyles: 404 (1916); Marloth: 154 (1925); Loes.: 173 (1942a); N. Robson: 386 (1966). Type: Cape, 'Sylvis Sitsikamma & Krakakamma (Georg, Uitenhage). Flor Jul. Fruct. Febr.', *Ecklon & Zeyher s.n.* (SAM!, lecto, here designated, S!, TCD!, Z!).

Elaeodendron papillosum Hochst. in Krauss: 305 [(1844) reprinted: 42 (1846)]. *Cassine papillosa* (Hochst.) Kuntze: 114 (1891); Davison: 334 (1927) *pro parte* excl.

syn. *C. lacinulata* Loes.; Palmer & Pitman: 1321 (1973); Coates Palgrave: 511 (1977); Coates Palgrave *et al.*: 64 (1985); Pooley: 278 (1993). Type: 'sylvis prope Natal, Julio 1839', *Krauss 270* (TUB, holo., BM!, K!, MO!, S!, TCD!).

Olea sp. Mellis: 312 (1875).

Icones: Graham: t. 3835 (1841); Coates Palgrave *et al.*: 64 (1985); Archer & Condy: t. 2112 (1995).

Medium to tall evergreen tree, glabrous; bark greyish with layers of powdery yellow pigment in exposed rhytidome, exfoliating in thin scales, surface longitudinally fissured. *Branchlets* subangular to terete, grey-brown, lenticels prominent, black. *Leaves* opposite; lamina elliptic to oblong, dark green above, paler green below, (15–) 35–75 (–220) x (10–) 15–45 (–70) mm, base attenuate to cuneate, apex acute to acuminate, margin glandular-denticulate to prominently spinulose dentate on juvenile shoots; coriaceous; venation ± raised above and below in dried material, fine reticulation less conspicuous, indistinctly brochidodromous to semi-craspedodromous in juvenile leaves; petiole 4–10 mm long; stipules brownish black. *Inflorescences* usually pedunculate, ± compact dichasial, axillary towards apices of branchlets, 1–15 flowered, peduncle (0) 3–12 mm long; bracts minute, bracteoles occasionally present. *Flowers* bisexual, 4-merous, ± 3 mm in diam., pedicels 1–2 mm long. *Sepals* greenish, ovate, 1.5 x 1 mm, fleshy. *Petals* whitish green, broadly ovate, 1.5 x 1.5 mm, spreading. *Stamens* erect to spreading; filaments 0.5 mm long, anthers 0.5 mm long, dorsifixed, introrse. *Disc* quadrangular, subentire with sinuses at the point of stamen insertion, flat to concave. *Ovary* 2-locular; style and stigma inconspicuous. *Fruit* drupaceous, ellipsoid, cream, 20–32 x 10–15 mm, stone narrowly elliptic, tapered at both ends. *Seeds* pale brown, narrowly ellipsoid, 15–20 x 4–5 mm; embryo with fleshy cotyledons (Plate 2 in frontispiece, Figure 31).

Elaeodendron croceum occurs on the margins of coastal and montane forest from near Ladismith in the Western Cape to northern KwaZulu-Natal in the east, as well as in isolated spots on the Mpumalanga and Eastern Zimbabwe escarpment (Figure 35). It is most abundant and well known in the southern Cape forests where it was once popular for its bright yellow, durable wood. It is also fairly abundant on St. Helena, which could be explained by the establishment of plantations of the tree by early colonists. Mellis (1875) considered this species, which he placed under *Olea ?* sp. and called wild olive, as very common and 'one of the handsomest trees on the island'. *E. croceum* is distributed by fruit bats, Rameron Pigeons and even elephants (pers. obs., Phillips 1925, 1927).

Flowering occurs sporadically in summer. Fruit usually ripens after a year.

Thunberg (1794b) and Pappe (1858) recorded the use of the fine and durable wood of *E. croceum* for the making of all kinds of furniture, building material, wagons as well as buttercasks. Most parts of the plant are poisonous and valued for medicinal and magical properties (Watt & Breyer-Brandwijk (1962). *E. croceum* is also a decorative garden plant.

Elaeodendron croceum has been subject to consideral nomenclatural confusion and name changes, evident in literature and on herbarium sheets. Since Ecklon & Zeyher (1834/5), most authors have mistaken the identity of Thunberg's *Ilex crocea*. The type specimen was carefully studied at UPS and there can be no doubt as to its identity. It is likely that Thunberg encountered this species in the Grootvadersbosch, near Swellendam (Thunberg 1794b). On a subsequent visit in 1774, Thunberg was disappointed in again finding few trees in flower or fruit, but continued collecting sterile specimens, certainly amongst others the present species. *Elaeodendron croceum* is frequent in the southern Cape, while the species with which many authors have confused it, *E. zeyheri* (*Cassine crocea auct.*), does not occur west of Port Elizabeth.

The responsibility for this nomenclatural confusion can evidently be laid upon Ecklon & Zeyher (1834/5), who published *E. capensis*, but also chose a superfluous name *Crocoxylon excelsum* as the new name for *E. croceum*. The generic description of *Crocoxylon* and the specimens cited, however, correspond with *Elaeodendron zeyheri*. This confusion has been perpetuated by most subsequent workers, e.g. Robson (1965, 1966) and Coates Palgrave (1977), the latter publishing a description of *Cassine crocea auct.* that applies to *E. croceum.* Most information in literature hitherto published under *E. croceum auct.* applies to this species.

Several vernacular names, including ‘Saffron’ (or ‘Common Saffron’, ‘Saffron wood’) and ‘geelhout’ (yellow wood) were first recorded by Thunberg (1794b). The specific epithet chosen by Thunberg refers to the presence of a bright yellow pigment in the bark.

Selected specimens examined

Zimbabwe

—**1832** (Mutare): Umtali, N Vumba, SSW of Lion Rock, (–BA), *Muller 3378* (SRGH); Inyanga, Nyamzu[I]wa River (–BD), *Wild 1573* (K, SRGH); Inyanga, Forest on summit of Hongo, Mt Kukwanisa training school (–DA), *Chase 8475* (K, SRGH); Mutare, Gunner's Way Cecil Kop Nature Reserve (–DC), *Burrows 2276* (SRGH); Umtali [Mutare], Stapleford, near T. Meikle Forest Research Station (–DD), *Muller 2983* (SRGH).

—**1932** (Melsetter): Brumba, plot Mrs Hayter, 23.5 km from Mutare (–BB), *Van Wyk BSA 1197* (PRE, PRU); Melsetter, Tarka Forest Reserve (–DD), *Goldsmith 27/71* (B, J, K, MO, P, PRE, SRGH).

—**2032** (Chipinge): Mount Selinda, between Mission station and border post (–BA), *Van Wyk BSA 1236* (PRE, PRU); Gungunyana Forest Reserve, Top of Chiredza Gorge (–BC), *Goldsmith 25/71* (K, PRE, SRGH).

South Africa

—**2229** (Waterpoort): Hanglip (–DD), *Legat 68* (K).

—**2230** (Messina): Maname (–CC), *Netshiungani 1456* (J, PRE); Sibasa, Pepiti Falls (–CD), *Smuts & Gillett* 3183 (BOL, PRE).

—**2329** (Pietersburg): Happy Rest (–BB), *Gerstner 6092* (PRE); Houtboschberg (–DD), *Burtt Davy 1242* (BOL).

—**2330** (Tzaneen): Westfalia Estate, Berg above Grootbos Forest Reserve (–CA), *Scheepers 675* (K, PRE).

—**2430** (Pilgrim's Rest): The Downs (–AA), *Renny DB50* (K, PRE).

—**2731** (Louwsburg): Mist Belt Forest, Ngomi [Ngome] (–CD), *Gerstner 4442* (PRE).

—**2732** (Ubombo): Sibayi (–AA), *Green Sibayi Project-333* (GRA, PRE); *335* (GRA); Sordwana Bay near Nature Reserve gate (–BC), *Stephen, Van Graan & Schwabe 1028* (PRE); Sordwana Bay (–DA), *Vahrmeijer & Tölken 300* (PRE).

—**2829** (Harrismith): Delville (–CB), *Smuts PRE-58360* (BOL, PRE).

—**2830** (Dundee): Krantzkop, The Kop (–AA), *Edwards 809* (K, PRE); *2093* (PRE); Qudeni Forest (–DC), *Edwards 1506* (K, PRE); Kranskop, near Solitude Store (–DD), *Acocks 11651* (PRE).

—**2831** (Nkandla): Nkandla Forest (–CA), *Edwards 2310* (K, PRE, Z); Eshowe, Hlinza (–CD), *Moll 2787* (K, PRE); Mtunzini, Twinstreams, dune forest near arboretum (–DD), *Van Wyk 2655* (PRE).

—**2832** (Mtubatuba): St Lucia, Western Shores, Hell's Gate peninsula (–AB), *Nicholas & MacDevette 1268* (K); Maphelane Nature Reserve (–AD), *MacDevette 226* (C, K, PRE); Eastern Shores State Forest (–BA), *Phillipson 3326* (GRA).

—**2930** (Pietermaritzburg): Farm Ehlatini, Karkloof (–AC), *Moll 3442* (K, PRE, S); 15 mile NW of New Hanover, Edge of Yellowwood Forest (–AD), *Codd 1480* (K, P, PRE); 12 mile NW of York (–BC), *Acocks 12738* (K, PRE); Hawaan Forest (–CA), *Moll 3102* (K); *3198* (K, PRE, S); [Pieter]maritzburg (–CB), *Carnegie 1666/28* (NBG); Inanda (–DB), *Wood 937* (BM, K); Krantzkloof Nature Reserve (–DD), *Moll 3318* (K, PRE).

—**2931** (Stanger): Umhlanga Rocks (–CA), *Moll 2411* (PRE); Durban, Albert Park (–CC), *Moll 3580* (PRE, S).

—**3029** (Kokstad): Weza State Forest, Foothills of Ngeli Mountain near Lovedale lookout (–DA), *Van Wyk 7547* (PRE, PRU).

—**3030** (Port Shepstone): Dumisa, Hlutankunge (–AD), *Rudatis 1768* (PRE); Hell's Gate, Oribi Gorge (–CA), *Balkwill & Cron 302a* (J, PRE); Timbankulu Forest (–CB), *Strey 8740* (K, PRE); Umtamvuna River (–CC), *Nicholson 1312* (PRE); Uvongo River (–CD), *Nicholson 1347* (PRE).

—**3129** (Port St Johns): Coffee Bay (–CC), *Wells 3512* (GRA); Hluleka Forest near Ngqelene (–CD), *De Winter 8829* (PRE).

—**3130** (Port Edward): Umtamvuna Nature Reserve (–AA), *Abbott 6348* (PRE).

—**3226** (Fort Beaufort): Amatole Mountains, near Cata (–CA), *Furness & Phillipson 265* (MO, PRE); Amatole Mountain, Hogsback Pass (–DB), *Phillipson 883* (K, PRE, UPS); Dal Eendracht Farm, S of Alice (–DD), *Giffen FH-2259* (PRE).

—**3227** (Stutterheim): Keiskamma Hoek, Wolf River Forest (–CA), *Wells 2797* (GRA, PRE); Stutterheim, 8.4 mile from Stutterheim on Keiskamma Hoek road (–CB), *Marais 527* (BOL, GRA, K, PRE); Pirie (–CB), *Sim 2154* (BOL, NBG, PRE); King Williamstown, Pirie Forest (–CC), *Von Gadow 213* (GRA); 3 mile from Amabele (–DA), *De Vries 114* (PRE).

—**3228** (Butterworth): 12.4 mile from Butterworth on Kentani road (–AD), *Marais 468* (GRA, K, PRE); 9.2 mile from Elliotdale on Willowvale road (–BA), *Marais 493* (GRA, K, PRE); 2 mile inland of The Haven, Bashee Mouth (–BB), *Wells 3557* (GRA, PRE); Dwessa Forest Reserve (–BD), *Marais 486* (BOL, GRA, K, PRE); Kei

Mouth (–CB), *Flanagan 862* (GRA, MO, NBG, P, PRE, Z); Queensberry Bay (–CC), *Acocks 21058* (PRE); Wavecrest (–DA), *Lubke s.n.* (GRA).

—**3321** (Ladismith): Zwartebergen, Seven Weeks Poort (–AD), *Marloth 8448* (PRE).

—**3322** (Oudtshoorn): George (–CD), *Prior* (K, MEL, PRE, Z); Ebb and Flow Nature Reserve, valley of the Touw River (–DC), *Taylor 7997* (PRE, STE); Knysna, Millwood (–DD), *Lam & Meeuse 4724* (S).

—**3323** (Willowmore): Deepwalls Forest (–CC), *Bos 857* (B, LISC, STE); Blauwkrantz Pass (–DC), *Galpin 3885* (GRA, PRE); Storms River High Forests (–DD), *Keet 544* (GRA, STE).

—**3325** (Port Elizabeth): Groendal Wilderness Reserve, Zunga Catchment basin (–CA), *Scharf 1520* (K, PRE); Port Elizabeth, Springfields (–CB), *Paterson 2190* (PRE).

—**3326** (Grahamstown): Howieson's Poort (–AD), *MacOwan 713* (BM, BOL, K, P, PRE, UPS, Z).

—**3327** (Peddie): Fort Grey Forest Reserve (–BB), *Wells 3911* (GRA, LISC, PRE).

—**3422** (Mossel Bay): Skaapkop River Mouth (–AB), *O'Callaghan, Fellingham & Van Wyk 158* (PRE, STE); Kaaimans River, on National road from Mossel Bay to Wilderness at picnic spot (–BA), *Marsh 1307* (K, PRE, STE); Goukamma Nature Reserve (–BB), *Van der Merwe 2175* (PRE, STE).

—**3423** (Knysna): Knysna (–AA), *Burchell 5527* (K); Keurbooms River (–AB), *Gillett 1336* (BOL, STE).

St. Helena

—**15S05W** St. Helena, Plantation, *Nielsen 1617* (C).

2. *Elaeodendron schweinfurthianum* (Loes.) Loes. in Natürlichen Pflanzenfamilien. III. 5. Nachtr.: 223 (1897); 173 (1942a); Loes. & Engl.: 233 (1921); Brenan & Greenway: 123 (1949); Beentje: 337 (1994); N. Robson *et al.*: 31 (1994). Type: Somalia, Brava [Barawa], *Hildebrandt 1323* (K!, lecto., designated here, BM!).

Cassine schweinfurthiana Loes.: 550 (1893); 247 (1895b); Chiov.: 51 (1916); 132 (1932); Dale & Greenway: 133 (1961).

Elaeodendron somaliense Engl. *tantum in scheda*, Loes. 17: 550 (1893); ex Vatke in Engl.: 366 (1904). Type: [literature not available].

Elaeodendron schweinfurthianum (Loes.) Loes. var. *cyclophyllum* Chiov.: 132 (1932). Syntypes: Somalia, Brava, *Scasselati 218*; *219* (FI); Cu Daio, *Senni 41* (FI).

Elaeodendron schweinfurthianum (Loes.) Loes. var. *obovatum* Chiov.: 132 (1932). Type: Somalia, Bur Gao, *Senni* 96 (FI).

Shrub or lax tree up to 3 m; bark greyish brown, smooth or flaky, yellow pigment not observed. *Branchlets* subangular, grey, lenticels prominent, grey. *Leaves* opposite; lamina obovate, greyish green, (25–) 30–40 (–50) x (8–) 10–20 (–30) mm, base attenuate, apex rounded to minutely mucronate, margin entire, rarely with spinulose-denticulate teeth; coriaceous; venation ± raised on both surfaces in dried material, fine reticulation less conspicuous above, brochidodromous; petiole 4–7 mm long; stipules greyish. *Inflorescences* pedunculate, ± compact dichasial, axillary, 1(3)–10-flowered, peduncle 5–10 mm long; bracts minute, bracteoles occasionally present. *Flowers* bisexual (or unisexual, the respective parts not fully developed), 4-merous, ± 2.5 mm diam., pedicels ± 1 mm long. *Sepals* greenish, fleshy, depressed ovate, 0.6 x 1 mm. *Petals* cream or greenish, broadly ovate, 1.5 x 1.0 mm, spreading, apex rounded, lower half of the lamina thickened with fringed projections towards the apex. *Stamens* erect to spreading; filaments 0.5 mm long, anthers 0.2 mm long, dorsifixed, introrse. *Disc* ± quadrangular, subentire with sinuses at the point of stamen insertion, convex. *Ovary* 2-locular; style ± 0.2 mm, stigma entire or inconspicuously lobed. *Fruit* widely ellipsoid, green? when ripe, 8 x 5 mm, stone elliptic, ends rounded, thin, 0.5 mm thick. *Seed* single, seed-coat brown, widely ellipsoid, 5 x 3 x 1 mm; embryo with fleshy cotyledons.

A characteristic species of coastal bushland, swamps and forest margins, close to the sea and tidal lagoons from southern Somalia, through Kenya to southern Tanzania (Figure 36).

This species is closely related to *E. schlechterianum*, but is a much smaller shrub or tree with a different leaf shape, 4-merous flowers, 2-locular ovary, and smaller fruit. Robson *et al.* (1994) considered *E. schweinfurthianum* to be unisexual, but this needs confirmation in the field.

Selected specimens examined

Somalia

—01N44E: Brava (–AA), *Hildebrandt 1323* (BM, K).

Kenya

—01S40E: K7, Sabaki, 4 mile N of Malindi (–AC), *Polhill & Paulo 756* (K, PRE, UPS).
—01S41E: K7, Lamu, Kui Isl. (–CD), *Rawlins, 134* (K); K7, Kiunga, near Italian Border (–DC), *Dale 3528* (K).
—02S40E: K7, Garsen Witu road, 12.5 km towards Witu from Garsen ferry crossing, (–AC), *Faden & Faden 74/1067* (K, PRE); Lamu Isl., Mnazi Moja (–BD), *Greenway 8868* (K);
—03S39E: K7, Arabuko-Sokoke Forest, N of Sokoke Forest Station (–BD), *Musyoki & Hansen 1020* (C, K); K7, Kilifi (–DB), *Simpson 36* (K).
—03S40E: K7, Gede Forest, Gedi National Monument (–AC), *Gerhardt & Steiner 157* (UPS).
—04S39E: K7, Shimba Hills, Forest Station (–AB), *Magogo & Glover 1133* (K); K7, Likoni, S of Mombasa (–AC), *Baagøe, Danielsen & Vollesen 20* (C); K7, Kitoni, near Kikoneni (–AD), *Makin 423* (K); K7, Mombasa (–BA), *Wakefield* (K); K7 Kwale, Diani Forest (–BC), *Gillet & Kibuwa 19871* (K, MO, P, UPS); K7, Ngoa [Ngowa], Vanga (–CA), *Graham 2193* (BM).

Tanzania

—05S39E: T3, Machui, sea level (–BA), *Faulkner 1867* (S).
—06S39E: Zanzibar, Mazizini (–AA), *Faulkner 2283* (S); Zanzibar, Ras Fumba [Fumba], Shamba area (–AD), *Frazier 2300* (MO); T6, Kunduchi (–CA), *Harris 4981* (MO); T6, Msassani (–CD), *Vaughan 2709* (BM).
—08S38E: T8, Kingupira Forest, Ground-water forest (–BC), *Vollesen 2399* (C).

3. **Elaeodendron aquifolium** (Fiori) Chiov., Flora Somala 1: 125, t 47, fig. 1. (1929); Chiov.: 133 (1932); Loes: 173 (1942a); N. Robson: 344 (1989); Beentje: 337 (1994); N. Robson *et al.*: 32 (1994). Type: Somalia, Gezira, Lugh, *Paoli 1007* (FI, lecto, designated by Robson (1989); K, photo!).

Cassine aquifolia Fiori: 50 (1915) as *aquifolium*; Chiov.: 51 (1916); Dale & Greenway: 133 (1961).

Hartogia agrifolia Chiov.: 125 (1929), as *agrifolium*; Loes.: 180 (1942a). Type: Somalia, Obbia between Scemarca Hassan and Tobunjab, *Puccioni & Stephanani 643* (FI, holo.)

Elaeodendrum papillosum non Hochst.: Brenan & Greenway: 123 (1949).

Icones: Chiov. 47, t.1, photo. (1929).

Suffrutex, shrub or small irregular tree up to 4 m tall; bark greyish brown, cracking longitudinally, yellow pigment present, at least on root bark. *Branchlets* subangular to terete, greyish-brown, lenticels inconspicuous. *Leaves* opposite to subopposite; lamina elliptic to ovate, (25–) 35–60 (–85) x (5–) 10–25 (–35) mm, greyish green above, paler below, base cordate to attenuate, apex spinose, margin prominently aculeate with long stiff spines, 2–4(5) on each side; crustaceous; venation ± raised on both sides in dried material, fine reticulation more conspicuous above, mixed craspedodromous; petiole 1–4 mm long; stipules greyish. *Inflorescences* pedunculate, irregular dichasial, axillary, 1–4 flowered, peduncle 5–20 mm long; bracts minute. *Flowers* bisexual, 5-merous, 3–4 mm diam., pedicels 2 mm long. *Sepals* greenish, membranous, ± 1.0 x 1.0 mm, circular to depressed ovate, apex rounded, margin entire. *Petals* greenish, ovate, 2.5 x 1.5 mm, margin entire, apex rounded, spreading. *Stamens* erect; filaments ± 0.5 mm long, anthers 0.5 mm long, dorsifixed, introrse. *Disc* subentire with sinuses at the point of stamen insertion, flat to slightly convex. *Ovary* 2-locular; style 0.2 mm long, stigma inconspicuous. *Fruit* drupaceous, widely ellipsoid, green? when ripe, 10–15 x 8–12 mm, stone 1–2 mm thick. *Seeds* 1, seed-coat dark brown, widely elliptic and flat on one side, 8 x 5 x 2 mm; embryo with fleshy cotyledons.

Found in the dry regions of Somalia and Kenya, where it occurs in low, deciduous woodland (Figure 36). *E. aquifolium* is singular in its very stiff and pronounced leaf spines.

Reported as unisexual (Robson *et al.* 1994), but this was difficult to confirm with the few specimens studied in detail. The ovary is 2-locular, not 4-locular as reported by Chiovenda (1929) and Robson *et al.* (1994).

Selected specimens examined

Somalia

—**5N48E**: Plateau, NW of Gawen village (–CB), *Gillett, Hemming & Watson 22272* (K).
—**4N45E**: Near Berdale, 68 mile SE of Lugh Ferrandi (–CC), *Bally 9327* (K).
—**3N44E**: Bur Heybe (–AB), *Brien 104* (K).
—**3N45E**: Hiiraan, 2.5-3 km NE of turning to Jalalaqsi on Buulo Barde road (–BC), *Thulin & Abdi Dahir 6403* (K, UPS).
—**2N42E**: Bay Region, 0215N 4248 (–BD), *Beckett & White 1576* (K); 73 km N of Bardera on road to Garba Harre (–CD), *Gillett & Hemming 24766* (K).
—**2N45E**: Coast rd, 28 km NE of Mogadishu (–BA), *Gillett & Hemming 24453* (K).
—**0N42E**: Homboy, 1 km W of Bagdad (–BC), *Madany 89/5* (UPS).
—**0S41E**: S Somalia, 46 Km N of bend in Border, *Gillett, Hemming, Watson & Julin 25234* (K).

Ethiopia

—**4N41E**: Sidamo, 20 km N of Bokol Mayo on road to Filtu (–CB), *Gilbert, Sebsebe & Vollesen 8208* (C, K, UPS).

Kenya

—**03S39E**: K7, Voi, Tsavo National Park, Gate Sala (–AA), *Greenway & Kanuri 12940* (K).

4. Elaeodendron buchananii (Loes.) Loes. in Natürlichen Pflanzenfamilien III, 5, Nachtr 223 (1897); Loes. & Engl.: 223 (1921); Eggeling: 41 (1940); 79 (1952); Burtt Davy & Hoyle: 37 (1936); 40 (1958); N. Robson: 388 (1966); 344 (1989); Mendonça & Sousa: 183 (1968); Verdcourt & Trump: 100 (1969); Villiers: 7 (1975); Beentje: 337 (1994); N. Robson *et al.*: 32 (1994). Type: Njassaland [Malawi], without locality, *Buchanan 710* (B†, holo; BM!, K!).

Cassine buchananii Loes.: 551 (1893); 247 (1895b); Keay & Blakelock: 626 (1958); Wilczek: 130 (1960); Dale & Greenway: 133 (1961); Irvine: 453 (1961); White: 216 (1962); Boughey: 163 (1964).

Elaeodendron afzelii Loes.: 157 (1900); 174 (1942a); Hutchinson & Dalziel: 445 (1927). Type: Sierra Leone, *Afzelius* (B†, holo.; UPS!).

Elaeodendron warneckei Loes.: 309 (1908); 174 (1942a); Exell & Medonça: 11 (1956); Types: Togo, near Lomé, *Warnecke 45* (B†, lecto, designated by Robson *et al.* 1994; BM, EA, K!, P!).

Elaeodendron keniensis Loes.: 489 (1926); Eggeling: 79 (1952), as nr. *E. keniense*. Type: Kenya, near Nyeri, *Fries & Fries 206* (B†, holo.; K, UPS!).

Elaeodendron friesianum Loes.:490 (1926); 174 (1942a). Type: Kenya, near Meru [Mt. Aberdare], *Fries & Fries 1731* (B†, holo.; K, UPS!).

Elaeodendron stolzii Loes.: 35 (1934); Brenan & Greenway: 123 (1949). Type: Tanganyika, Rungwe Distr. near Ulambya, *Stolz 2250* (B!, holo.; BM!, C!, MO!, P!, PRE!, S!, SAM!, UPS!).

Elaeodendron glaucum Pers. var. *kamerunense* Loes.: 35 (1934); 173 (1942). *Cassine glauca* (Pers.) Kuntze var. *kamerunensis* (Loes.) Wilczek: 131 (1960). *Elaeodendron kamerunense* (Loes.) Villiers: 10 (1975). Type: Zaire, Lake Albert, Nioka, *Gomez 3* (BR, *neo.*, designated by Villiers: 10 (1975).

Elaeodendron sp. *sensu* Battiscombe: 91 (1936).

Elaeodendron albivenosum Chiov.: 132 (1932). *Cassine albivenosa* (Chiov.) Cuf.: 482 (1958); 39 (1969). Type: Somalia, Jak Omisso, *Senni 275* (FI, holo.)

Elaeodendron sp. *sensu* Eggeling: 80 (1952).

Icones: Robson: 389, t. 82 B (1966); Verdcourt & Trump: 101 (1969); Villiers: 9, t. 2; 11, t. 3 (1975); Robson *et al.*: 30, Fig 7, 4–7 (1994).

Shrub or tree up to 30 m tall; bark greyish to dark grey, smooth with powdery yellow pigment not observed. *Branchlets* subangular, grey-brown, lenticels prominent, whitish. *Leaves* opposite to subopposite; lamina elliptic or slightly obovate, pale green to greyish above, greyish below, (30–) 50–75 (–125) x (20–) 30–50 (–75) mm, base rounded to attenuate, apex retuse, rounded or acute, margin glandular-crenulate, 5–15 crenations on each side; coriaceous; venation ± raised on both sides in dried material, fine reticulation less conspicuous, brochidodromous; petiole 5–12 mm long; stipules greyish. *Inflorescences* pedunculate, ± regular dichasial, axillary or in axils of bracts on specialized shoots, 50 mm long, forming a paniculate many-flowered inflorescence, 15–40 flowered, peduncle 10–18 mm long; bracts minute. *Flowers* unisexual, with petaloid staminodes in female flowers, 5-merous, 3–4 mm diam., pedicels 2 mm long. *Sepals* greenish, membranous, ± 1.0 x 1.0 mm, circular to depressed ovate, apex rounded, margin entire. *Petals* cream or greenish, ovate, 1.6 x 1.0 mm, margin entire, apex rounded, spreading. *Stamens* of male flowers ± erect; filaments 1.2 mm long, inserted below margin of disc, anthers 0.5 mm long, dorsifixed, introrse; staminodes of female flowers usually petaloid, slightly smaller and similar in shape to petals. *Disc* subentire with shallow sinuses at the point of stamen insertion, convex in female flowers, flat in male flowers. *Ovary* 2- or 3(4)-locular; style 0.5 mm long, stigma entire or inconspicuously lobed, absent in male flowers. *Fruit* drupaceous, widely ellipsoid, cream or yellow, 20–25 x 15–20 mm, stone ellipsoid, tapered at both ends, 2–3 mm thick. *Seeds* 1 or 2, brown, elliptic and flattened on one side, 12 x 5 x 2 mm; embryo with fleshy cotyledons.

Elaeodendron buchananii occurs in evergreen and riverine forest, deciduous woodland, grassland as well as on termitaria. The most widespread of the African species of *Elaeodendron,* it occurs in most countries from west to east in Central Africa (Figure 35). This wide distribution perhaps accounts for the many synonyms recorded. Easily recognized in *Elaeodendron* by its dioecious flowers with petaloid staminodes, a character shared with the Central American *E. xylocarpum*.

E. buchananii is very common in parts of Uganda where it is a possible source of timber production. The wood is fine textured and hard, but can be worked to a smooth surface (Dale & Greenway 1961). Dale & Greenway (1961) and Verdcourt & Trump (1969) also reported it as extremely poisonous to livestock. Verdcourt & Trump (1969) mentioned that in grassland the species is often small and shrubby within reach of stock with fatal results; however, it is frequently browsed by giraffe.

Elaeodendron kamerunense may well be regarded as a good taxon differing from *E. buchananii* in its bisexual flowers, inflorescences less dense and leaves not coriaceous (Villiers 1975). No material of the species was studied here. Villiers studied material of the neotype only, since the original material was apparently destroyed in B. More material and fieldwork are needed to evaluate the above-mentioned differences between the two taxa, which may be insufficient to distinguish the two species. The selected neotype from Lake Albert, Zaire is possibly suspect since it is collected quite far from the original localities in Cameroon cited by Loesener (1934).

Selected specimens examined

Sudan

—**07N27E**: R. Numatinna (–BA), *Turner 102* (K).

Ethiopia

—**7N35E**: Illubabor, 3 km s of Tepi (–AB), *Friis, Gilbert & Vollesen 4142* (C, K, UPS).
—**7N36E**: Wush plantation, 22 km W of Onga (–AC), *Meyer 9075* (K); Gobeb River, N of bridge on Jimma-Bongo rd (–AD), *Friis, 2339* (K).
—**9N38E**: Mt Entotto, about 5 Km N of Addis Ababa (–BB), *De Wilde & De Wilde-Duyfjes 8252* (C, P).

Ghana

—**7N2W**: Hani near Nsawkkaw (–CD), *Hall & Lock 43919* (K, MO).

Togo

—**6N01E**: Lomé (–CA), *Warnecke 45* (BM, K, P).

Nigeria

—**6N11E**: Mambilla Plateau, banks of river at Mayo Selbe (–CB), *Chapman 2753* (K).

Central African Republic

—**4N17E**: Bangui, *Guigonis & Normand 450* (K, P).

Cameroon

—**4N13E**: Houndi, Bertoua (–DA), *Letouzey 2659* (K, P).

Zaire

—**1N29E**: Irumu (–BD), *Bequaert 2891* (K).
—**0326E**: Katanga (–BC), *Ringoet 119* (K).
—**0729E**: Ganza, Kamandula (Parc National de l'Upemba) (–AD), *De Witte 6514* (C, K).

Uganda

—**4N32E**: Imatongs (–BB), *Eggeling 3565* (K).
—**3N31E**: Koich River, Rumogi (–BC), *Eggeling 1827* (K); Amua West, Madi (–DB), *Eggeling 1808* (K).
—**3N32E**: Mountain Forest above Lututuru, Chua (–DB), *Eggeling 3498* (K).
—**2N31E**: Luku Local Forest reserve, Ajiia (–CC), *Obina* (K).
—**1N33E**: Seren[g]e, Teso (–DA), *Chandler 1102* (K).
—**1N34E**: U3, Sit[i] River, Kyesowen[ri] (–BC), *Eggeling 5731* (K).
—**0N30E**: U2, Kibale Forest, Fort Portal (–CB), *Clutton-Brook 505* (K).
—**0N31E**: Mi[u]zizi, Lake Albert (–CD), *Bagshawe 1320* (BM).
—**0N33E**: U4, Maliva, Forest Path (–CA), *Dümmer 4425* (BM, P).
—**0S30E**: Kigarama Hill, Ruampara, (–DC), *Eggeling 643* (K).
—**0S31E**: U4, Buddu (–BC), *Dawe 977* (K).

Rwanda

—**01S30E**: Biumba (–CA), *Troupin 5008* (K).

Kenya

—**0N33E**: K5, Port Victoria, 200 yards from lake (–BB), *Glasgow 48/4* (K).

—**0N34E**: K3, SE Mt Elgon, *Jackson, com. Lugard 318a* (K, PRE).
—**0N37E**: K4, Meru, Lower Imenti Forest, *Vercourt & Polhill 2983* (K, PRE).
—**0S35E**: K5, Aitibu Sotik (–CA), *Dale 1015* (K, P, PRE).
—**0S36E**: K3, Mt Aberdare (–BC), *Fries & Fries 1731* (K, UPS); K3, Mt. Margaret (-DC), *Bally 1159* (K).
—**01S34E**: K6, 3 mile E of Lolgorian, Masai area (–BB), *Edwards 3120* (K).
—**01S35E**: K6, Mara Masai Reserve, Egerok [Keekorok] Forest (–CA), Bally 5444 (C, K).
—**01S36E**: K4, Muguga (–BA), *Kirika 507* (K, PRE); K4, Mbaghati Stream (–BC), *Rogers 543* (K, S); K4, Nairobi, High Ridge Golf Course (–BD), *Bally 102* (BM, K).
—**01S37E**: Thika Falls (–AA), *Pole Evans & Erens 1163* (K, P, PRE); K4, Mua Hills (–AC), *Hemming 231* (K); Mutanga (–BC), *Battiscombe 642* (K).
—**02S37E**: Emali Hill (–AB), *Van Someren 108* (K).

Tanzania

—**01S31E**: Minziro Forest Reserve, Bukoba distr. (–BA), *Procter 928* (K).
—**01S34E**: Serengeti, Kogateu[n]dr[e]-Nyambiri (–DB), *Herkotter 664* (K).
—**01S35E**: T1, Klein's Camp, Coliondo (–CA), *Tanner 1834* (K).
—**02S37E**: T2, Ketembelion, OlMolog, West Kilimanjaro (–CC), *Freyburg EA15510* (K).
—**03S37E**: Moshi Distr., Mt Kilimanjaro (–AD), *Hughes 222* (K).
—**05S36E**: T5, Mpwapwa distr., Njoge Mt. F.R. (–DD), *Ruffo 1462* (K).
—**06S30E**: T4, Mwesi, Mpanda distr. (–AB), *Procter 1899* (K).
—**08S35E**: T7, Iringa, Ngwazi (–CB), *Lovett & Lovett 698* (MO, PRE).
—**08S38E**: T8, Selous Game reserve, Kingupira (–BC), *Vollesen 2700* (C, K).

Angola

—**09S14E**: Malang[j]e (–DD), *Gossweiler 1412* (BM, K, P).
—**14S13E**: Serra E Chela, Uahita, Vila Arriaga (–CD), *Gosweiler 12994* (BM, MO).

Zambia

—**08S31E**: River Kalambo, just above Falls (–CA), *Brenan & Greenway 8179* (K).
—**10S32E**: Isoka (–BA), *Fanshawe 7204* (K).

—**12S26E**: Mufulira (–CA), *Fanshawe 1551* (K).

—**12S28E**: Kitwe (–CC), *Fanshawe 11480* (K); Ndola Botanical [Forest] Reserve (–DC), *White 3196B* (K).

—**13S28E**: Luanshaya (–AB), *Fanshawe 1403* (K); Ndola distr., Mpongwe (–AC), *Grout 25/49* (K).

—**14S24E**: Mankoya (–DD), *Fanshawe 8990* (K).

Malawi

—**0933**: Chendo river, between Fort Hill and Chisenga (–CD), *Robson 555* (BM, K, PRE).

—**1033**: Chitipa distr., lower Mondwe river (–BD), *Brummitt & Synge WC231* (K).

—**1434**: Dedza mountain forest (–AD), *Banda 476* (BM, SRGH).

—**1535**: Zomba, Mhita tobacco estate, Thondwe (–AC), *Chapman & Patel 5883* (K); Zomba, *c.* 1 km upstream from the Mlunguzi bridge on Old Naisi road (–AD), *Chapman, Patel & Balaka 6425* (K).

5. ***Elaeodendron schlechterianum* (Loes.) Loes.** in Natürlichen Pflanzenfamilien III. 5, Nachtr. 1: 223 (1897); 173 (1942a); N. Robson: 387 (1966); N. Robson & Sousa: 35 (1969); Beentje: 337 (1994); N. Robson *et al.*: 29 (1994). Type: Mozambique, Tete, Boruma, *Menyhart 2a* (Z!, holo.).

Cassine schlechteriana Loes.: 432 (1896); Schinz: 60 (1905); 78 (1937); Coates Palgrave: 513 (1977).

Cassine lacinulata Loes.: 432 (1896); Schinz: 60 (1905); 78 (1937). *Elaeodendron lacinulata* (Loes.) Loes.: 223 (1897). Type: Mozambique, Tete, Boruma, *Menyhart 1a* (Z!, holo.).

Elaeodendron stuhlmannii Loes.: 156 (1900); Loes. & Engl.: 233 (1921); Loes.: 174 (1942); Brenan & Greenway: 124 (1949). *Cassine stuhlmannii* (Loes.) Blakelock 12: 555 (1957). Syntypes: Tanzania, 'Zanzibarküste: Usaramo, Kidenge', *Stuhlmann 6326* (B†); 'Station N'honge in NW-Usaramo im Walde bei Dengua', *Stuhlmann 8652* (B†).

Elaeodendron bussei Loes. 41: 309 (1908); Loes. & Engl.: 233 (1921); Brenan & Greenway: 123 (1949); Type: Tanzania, Lindi, *Busse 2412* (B†, holo.; EA).

Elaeodendron papillosum sensu Brenan & Greenway: 123 (1949), *non* Hochst.

Elaeodendron capense sensu Burtt Davy & Hoyle: 37 (1936); 40 (1958) *non* Eckl. & Zeyh.

Shrub or tree up to 18 m tall; bark greyish brown, smooth or finely reticulate with yellow pigment not observed. *Branchlets* subangular to terete, grey to brown, lenticels prominent, grey. *Leaves* opposite or subopposite; lamina elliptic to broadly obovate, greyish green, often glossy above, paler green below, (15–) 25–100 (–130) x (10–) 15–35 (–80) mm, base attenuate, apex retuse, occasionally rounded or cleft, margin entire or glandular denticulate to spinulose-glandular-denticulate; coriaceous; venation ± raised on both surfaces in dried material, fine reticulation less conspicuous, brochidodromous to semicraspedodromous; petiole 4–10 mm long; stipules greyish. *Inflorescences* pedunculate, ± compact dichasial, axillary, (1)3–15-flowered, peduncle 4–10 mm long; bracts minute, bracteoles occasionally present. *Flowers* bisexual or partly unisexual with the respective parts not fully developed, (4)5-merous, ± 5.0 mm diam., pedicels ± 2 mm long. *Sepals* greenish, ovate to circular, 1.0 x 1.0 mm. *Petals* cream or greenish, elliptic to obovate, 3 x 2 mm, spreading, apex rounded, lower half of the lamina thickened with ridges ending with fringed projections towards the apex. *Stamens* erect to spreading; filaments 1 mm long, anthers 0.5 mm long, dorsifixed, introrse; staminodes of female flowers ± 1 mm long. *Disc* subentire with sinuses at the point of stamen insertion, concave. *Ovary* 3-locular; style and stigma inconspicuous. *Fruit* widely ellipsoid, cream, 15–25 x 12–20 mm, stone broadly ellipsoid, ends rounded, thin, ± 2 mm thick. *Seeds* 1 or 2, seed-coat dark-brown, widely ellipsoid, 11 x 5 x 2 mm; embryo with cotyledons fleshy.

Elaeodendron schlechterianum occurs in dry deciduous woodland or riverine forest, often on termitaria. Widespread in the southern and tropical east African countries of Kenya, Tanzania, Mozambique, Malawi, Zambia and Zimbabwe (Figure 37). Flowering October to April.

Most of Menyhart's specimens from Mozambique are at Z (Schinz 1905) with duplicates in C, K and WU (Vegter 1986). The two Zurich specimens were cryptically annotated in Loesener's hand and have been accepted as the holotypes of *E. schlechterianum* and *Cassine lacinulata* respectively. This taxon is not to be confused with *Cassine schlechteri* (= *Mystroxylon aethiopicum*) as in Gomes e Sousa (1967). We have followed Robson (1966) and Robson *et al.* (1994) in keeping *E. stuhlmannii* Loes. in synonomy. It might, however, be sufficiently distinct with its smaller, rounded leaves.

Selected specimens examined

Kenya

—0138: Mo[u]tomo Hill (–DC), *Bally 1581* (K).
—0140: Lamu Distr., Lunghi Forest Reserve (Proposed), 23 km E of Bodhei (–DD), *Luke & Robertson 1538* (K).
—0240: K7, Tana River, Garsen to Witu (–AD), *Luke & Robertson 1265* (K).

Tanzania

—0233: T1, Mkalama, Summit of Iramba Scarp, above Sekenke (–AB), *Burtt 3372* (K).
—0333: T1, Shinyanga (–CB), *Burtt 5567* (BM, K, P).
—0435: [N]kandoa Distr., Bubu valley (–AB), *Burtt 819* (BM, K).
—0438: T3, Lushoto Distr., West Usambara Mts, Baga I Forest Reserve (–CD), *Borhidi, Mziray & Pocs 84451* (UPS).
—0537: T2, Handeni Distr., Mbuga wa Mbaas near Loskiti[ok] Mtn (–AD), *Burtt 4909* (K).
—0539: T3, Tanga prov, 8 mile NW of Tanga (–AA), *Perdue & Kibuwa 8492* (K, UPS).
—0636: T5, Mpwapwa (–AD), *Hornby 44* (K).
—0638: T6, Mandera (–AB), *Saxleux 976* (P); T6, Bagan[mo]yo (–BD), *Kirk 2/71* (K).
—0639: T6, Pugu Hills (–CC), *Hawthorne 1744* (K).
—0838: T8, Kingupira, Selous Game Reserve (–BC), *Ludanga 1344* (C, K); T8, Kingupira Forest (–DA), *Vollesen 2743* (C, K).

Zambia

—0931: Abercorn, Chinakila (–AC), *Kafuli 192* (SRGH).
—1530: Katondwe (–AD), *Fanshawe 8122* (K).
—1627: Highlands of Batoka Country (–CD), *Kirk*, Jul 1860 (K).

Malawi

—**1435**: Zomba, Liwonde National Park (–CD), *Dudley s.n.* (SRGH).
—**1634**: Chickwawa, Lengwe Game Reserve (–CD), *Hall-Martin 902* (K, PRE, SRGH).

Mozambique

—**1038**: Niassa, Palma (–CD), *Barbosa 2143* (LISC).
—**1140**: Mechanga farm, 5 km from Mocimboa da Praia (–AD), *Gomes e Sousa 4696* (K, PRE).
—**1532**: Zambezi Valley, near Chicoa, 30 miles above Tete (–CB), *Hornby 2745* (K, PRE, SRGH).
—**1536**: Zambezia, Molumbo (–CB), *Phillips 2/70* (SRGH).
—**1634**: Manica e Sofala, Tambara [Nhacolo] (–CA), *Bond J10* (SRGH).
—**1637**: Zambesia, Ile, entre Ile e Mugeba (–CA), *Torre 5506* (LISC, SRGH).
—**1734**: Tete, Sinjal (–BB), *Barbosa & Carvalho 3762* (K).
—**1737**: Maganja da Costa (–BC), *Torre & Correia 14125* (LISC).
—**1834**: Beira, Gorongoza National Park, road 3, near saline areas (–DC), *Tinley 1927* (B, K, LISC, P, PRE, SRGH).
—**1935**: Chinizíua (–BA), *Gomes e Sousa 4435* (K, PRE).
—**2033**: Buzi, Mucheve (–DB), *De Carvalho* 748 (K).
—**2135**: Bazaruto island, Ponte Gengareme (–CB), *Mogg 28740* (SRGH).
—**2231**: Guija, Malvernia (–BA), *Barbosa & Lemos 8170* (K, LISC, SRGH).
—**2432**: Gaza, de Estivane para a Aldeia da Barragem, a 10 Km da Aldeia da Barragem (–BA), *Barbosa & de Lemos 8215* (K); Guijá, de Motase (–DD), *Mendonça 2774* (K, LISC, PRE).
—**2433**: Caniçado (Chamusca) (–AC), *Torre 7876* (B, Z); Macia, Muianga [Mananga] (–CA), *Pedrogão 1448* (K, PRE, SRGH); Bilene, do Chipenhe para Maniqueniqe, a 1 km depeis do Licile (–CD), *Lemos & Balsinhas 54* (BM, K, LISC, PRE, SRGH).
—**2532**: Magude, Chobela (–BA), *Torre 7054* (LISC).
—**2533**: Gaza, ao 6 km da Praia Chongoana para a praia Sepulveda (–BB), *Correia & Marques 1476* (PRE, SRGH).
—**2632**: Inhaca Island, Hlanganyani Hill (–BB), *Mogg 27614* (J); Maputu, andades 6 km da Ponta do Cure [Ouro] (–DD), *Correia & Marques 2965* (SRGH).

Zimbabwe

—**1529**: Urungwe, 18 km W of Mana Pools (–CC), *Pope 1985* (MO, PRE, SRGH); Mana Pools (–CD), *Gordon 50* (SRGH); Urungwe, near Sapi River (–DC), *West 4537* (BM, SRGH).
—**1628**: Urungwe, Chirundu Aerodrome (–DD), *Burrows 15/65* (SRGH); Matusadonha Game Reserve (–DC), *Mushori 12* (SRGH).
—**1629**: Urungwe (–DA), *Savory 692* (SRGH); Upper Chewore area, in alluvium of Kachowe River (–BB), *Cleghorn 1749* (SRGH).
—**1727**: Sebungwe, Chalala River (–CC), *Davies 1487* (K, SRGH).
—**2032**: Chikore Hills (–BC), *Swynnerton 167* (K, Z).
—**2132**: Denga, Sabi-Lundi Junction, Chitsa's Kraal (–AD), *Chase 2286* (BM, K, SRGH).

6. *Elaeodendron matabelicum* Loes. in Botanische Jahrbücher 40: 61 (1907); 174 (1942a); Eyles: 404 (1916); N. Robson: 385 (1966); N. Robson & Sousa: 33 (1969). Type: 'Rhodesia, Matabeleland, Baumsteppe bei Matoppos in etwa 1600 m, September', *Engler 2835* (B†). Neotype: Matobo, Farm Besna Kobila, *Miller 8290* (K!, neo., here designated; PRE!, SRGH!).

Cassine matabelica (Loes.) Steedman: 41 (1933); Coates Palgrave 511 (1977). *Elaeodendron capense sensu* Miller: 48 (1952).

Cassine sp. 1. White: 216 (1962).

Elaeodendron fruticosum N. Robson: 39 (1965); 386 (1966); N. Robson & Sousa: 34 (1969). Type: Mozambique, Gaza, Vila de João Belo beach, *Torre 3878* (LISC!, holo., SRGH!)

Icones: Robson: 389, t. 82 A (1966).

Medium to tall tree, up to 15 m high; bark greyish with yellow pigment absent or hardly visible, exfoliating in irregular scales, surface smooth to roughly fissured. *Branchlets* subangular to terete, greyish-brown, lenticels usually inconspicuous, whitish. *Leaves* opposite to subopposite, often ternate at apex, lamina elliptic to oblong or obovate, (25–) 35–65 (–85) x (8–) 15–25 (–35) mm, yellowish green, paler grey-green below, base attenuate to cuneate, apex acuminate, margin glandular-crenate, crenations usually 10–25 on each side, coriaceous; venation raised below and above in dried material, fine reticulation conspicuous above, inconspicuous below, indistinctly brochidodromous; petiole 8–15 mm long; stipules brownish black. *Inflorescences* pedunculate, stout, regularly dichasial, flowers densely arranged in each dichasium, numerous, 20–80-flowered; peduncle 10–45 mm long. *Flowers* bisexual, 5-merous, 3–5 mm diam.; pedicel ± 2 mm long. *Sepals* greenish, fleshy, often irregular, 0.7 x 1.3 mm, depressed ovate, apex rounded, margin entire. *Petals* greenish, oblong to ovate, 2.5 x 2.0 mm, margin entire, often undulate, apex rounded, spreading. *Stamens* initially erect, soon becoming recurved outwards with anthers almost touching the sepals; filaments ± 0.2 mm long, arising from near centre of disc, anthers 0.3 mm, dorsifixed, extrorse. *Disc* entire, convex, thick and fleshy. *Ovary* 3-locular; styles ± 2 mm long, stigma inconspicuously lobed. *Fruit* cream or yellow, drying reddish, widely ellipsoid to globose, 15–20 x 15–17 mm, ends rounded, stone widely ellipsoid to globose, 12–16 x 13–15 mm, ± 2 mm thick, seeds dark-brown, elliptic, flattened to triangular, 9.0 x 6.0 x 2.5 mm, embryo erect, widely elliptic (Figure 32).

A widespread and distinct species in dry deciduous woodland regions of Angola, Zambia, Zimbabwe and Mozambique (Figure 36). It is particularly plentiful near Bulawayo and in the Rhodes Matopos National Park, Zimbabwe. Unlike other widespread species of African *Elaeodendron*, few synonyms exist for this relatively homogeneous species.

Robson (1965) distinguished *E. fruticosum* from *E. matabelicum* on the basis of 'habit, fruit colour, and the size and number of flowers'. Robson based his observations of flowers on the type specimen, the only flowering collection available to him. Flowers of additional specimens have now been examined and are ± identical to those of *E. matabelicum*. The reported orange colour of the fruit (Robson (1965, 1966), instead of white or cream coloured as in other species of *Elaeodendron*, is doubtful. Fruit of *Torre 6717*, cited by Robson (1965) was described as 'esbranquiçadas' (=whitish). In two additional specimens cited by Robson (1965), *Gomes e Sousa 1828 & 1871*, the original Portuguese labels were replaced by new labels in French. It is likely the colour of fruit was incorrectly translated or that the colour of dried fruit, brown or reddish brown, was noted. It seems thus likely that *E. fruticosum* is merely a local variant of *E. matabelicum*. There is a need for more fieldwork on the taxon in Mozambique.

E. matabelicum is possibly the species of *Elaeodendron* referred to in Watt & Breyer-Brandwijk (1962) involved in 'trials of ordeal' in Zimbabwe. It is also used as an aphrodisiac, for abdominal and chest pains, menorrhagia and diarrhoea in Zimbabwe (Gelfand *et al.* 1985).

Selected specimens examined

Zambia

—**1331**: Luangwa Valley, Mfuwe (–BB), *Astle 4871* (SRGH).
—**1628**: Siamambo Forest Reserve, (–CB), *White 3014* (BM, PRE).
—**1727**: Mazabuka, Mochipapa Agricultural Station, (–CC), *White 6230* (SRGH).

Malawi

—**1333**: Dowa, Lake Nyasa Hotel (–DB), *Chase 3881* (BM, MO, PRE, SRGH, UPS).
—**1334**: Cape MacClear, Nkhunguni Hill, near the house (–DD), *Patel 84b* (SRGH).
—**1434**: Dedza mountain forest (–AD), *Banda 476* (SRGH).
—**1535**: Zomba, *c.*1 km. upstream from the Mlunguzi bridge (–AD), *Chapman, Patel & Balaka 6425* (SRGH).

Mozambique

—**1532**: Cabora Bassa, Marávia, arredores de Chicoa (–CB), *Mendonça 418* (K, LISC, P, SRGH); Cabora Bassa, Mágoè, 30 km para Chicoa (–DC), *Torre & Correia 18262* (LISC, K).
—**1734** (Chemba): Manica e Sofala, Maríngüè (–CD), *Bond 9b4* (SRGH).
—**1735**: Zambezia Distr., Serra Morrumbala (–BC), *Müller & Pope 1988* (LISC, SRGH).
—**1834** (Vila Paiva de Andrada): Manica e Sofala, Gorongosa National Park (–CD), *De Aguiar Macêdo 2237* (SRGH).
—**1933** (Vila Pery): Chimoio, perto do rio Vanduzi (–AB), *Andrada 1207* (LISC).
—**2135** (Bazaruto): Magaruque I. (–DC), *Gomes e Sousa 1871* (K, COI).
—**2235** (Mapinhane): Vilanculos (–AB), *Barbosa & Balsinhas 5017* (BM); Ponta [de] Barra Falsa (–DC), *Mogg 28929* (J, K, SRGH).

—**2335** (Inhambane): Old Inhambane (Estevam), 24 km E of Inhambane (–DC), *Gomes e Sousa 2023* (K).

—**2434** (Panda): Panda [Jacubécua] (–BB), *Gomes e Sousa 1871* (COI, K).

—**2533**: Gaza, Vila de Joã Belo [Xai-Xai](–BA), *Torre 3878* (LISC, SRGH); Gaza, Chongoéne, a cerca de 1 km do hotel (–BB), *Rodriques, Pereira, Marques & Balsinhas 247* (PRE, SRGH).

Zimbabwe

—**1630**: Lomagundi, Doma Hill (–AB), *Eyles 5703* (SRGH); Sipolilo, Great dyke, growing near vlei (–DA), *Nyariri 149* (SRGH).

—**1729** (Copper Queen): Melsetter, Biriwiri Reserve (–BC), *Ball 17* (SRGH, UPS).

—**1730** (Sindia): Mazoe, Umvukwes [Mvurwi] (–BB), *McGregor 117/37* (SRGH); Mazoe, Chipoli, Farm Shamva (–BC), *Moubray s.n.* (SRGH); Mazoe (–DB), *Bell 926* (SRGH).

—**1828** (Gokwe): Gokwe, 5 mile N.E. of the district commisioners office (–BB), *Bingham 984A* (SRGH).

—**1829** (Kwekwe): 8 mile SE of Gwelo (–CA), *Biegel 1608* (MO, SRGH).

—**1832** (Mutare): Inyanga, Cheshire (–BA), *Norlindh & Weimark 4812* (BM, MO, SRGH); Makoni, Rusape (–CA), *Edwards 2/36* (SRGH).

—**1928** (Nyamandlovu): Nyamandlovu, Pasture Research Station, (–CD), *Plowes 1640* (K, PRE, SRGH).

—**1932** (Melsetter): Chipinga district, along road between Skyline Junction and Cashell Valley (–DA), *Van Wyk BSA 1179* (PRE, PRU).

—**2027** (Plumtree): Bulalima Mangwe, Dombodema Mission Station about 1 km N of old Mission House (–BC), *Norrgram 208* (B, S, SRGH); Plumtree (–BD), *Meara 29* (PRE, SRGH); Bulalima Mangwe (–DD), *West 6614* (B).

—**2028** (Bulawayo): Bulawayo (–BA), *Sim 19240* (PRE); Matopos (–BC), *Hodgson 6/52* (MO, PRE, SRGH).

—**2029** (Filabusi): Belengwe, outside the district commisioners' office (–DB), *West 6633* (P, SRGH).

—**2030** (Masvingo): Fort Victoria, Flamboyant Motel, 2.5 km west of the Motel (–BB), *Gross 168* (MO, PRE, SRGH).

Botswana

—**2027** (Plumtree) Tsessebe (–DC), *Pole-Evans 3246(44)* (PRE).

7. ***Elaeodendron zeyheri*** Spreng. ex Turcz. in Bulletin de la Société Impériale des Naturalistes de Moscou 31(2): 452 (1858). Type: Eastern Districts, *Zeyher* (KW, holo.; K, MEL!, P!, S!).

Rhamnus zeyheri Spreng. *tantum in scheda* Zeyher, Harv.: 230 (1860) in syn. *nom. nud.* [name on sheets in P and S], *non Rhamnus zeyheri* Sond.

Cassine parvifolia E. Mey. *nom. nud.* [sheet in S].

Salacia zeyheri Planch. ex Harv.: 230 (1860); Sond.: 468 (1860) as syn. Type: presumably the same as for *Elaeodendron zeyheri.*

Crocoxylon excelsum Eckl. & Zeyh.: 128 (1834/5) *nom. illeg.*

Elaeodendron croceum auct. non Thunb.: Thonner: t.82 (1915). Crocoxylon croceum *auct. non* Thunb.: N. Robson: 41 (1965); 390 (1966). *Cassine crocea auct. non* Thunb.: Davison: 334 (1927); Coates Palgrave: 510 (1977), *pro parte*; Arnold & De Wet: 482 (1993).

Icones: Thonner: t. 82 (1915).

Small to medium evergreen tree; bark greyish with layers of conspicuous powdery yellow pigment, rhytidome exfoliating in thin scales, surface longitudinally fissured. *Branchlets* subangular to terete, greyish-brown, lenticels inconspicuous. *Leaves* opposite to subopposite, often ternate at the apex; lamina elliptic to obovate, greyish green, (10–) 25–40 (–60) x (5–) 10–25 (–35) mm, base cuneate to rounded, apex rounded, rarely acute; margin glandular-denticulate, 8–15 on each side; coriaceous; venation ± raised above and below in dried material, fine reticulation conspicuous, ± raised, indistinctly brochidodromous; petiole 3–5 mm long; stipules greyish. *Inflorescences* pedunculate, ± compact dichasial, axillary, (1)3–7 flowered, peduncle 5–10 mm long; bracts minute. *Flowers* bisexual, 4-merous, ± 5 mm diam.; pedicels 2–5 mm long. *Sepals* greenish, subcircular, 1.3 x 1.5 mm long, membranous, margin entire. *Petals* cream to green, oblong to ovate, 3 x 2 mm, sessile, spreading, apex rounded, margin entire. *Stamens* initially erect, soon curving outwards with anthers almost touching sepals; filaments ± 1 mm long, arising from near centre of disc, anthers 0.5 mm long, extrorse. *Disc* entire, convex, thick and fleshy. *Ovary* 4-locular; style short to astylous; stigma inconspicuous. *Fruit* drupaceous, spheroid to widely ellipsoid, yellowish, drying dark brown, 20–25 mm diam., stone broadly elliptic, surface smooth with equal spaced grooves across the ends, 15–20 x 11–14 mm diam., 2 mm thick. *Seeds* 1 or 2 per fruit, seed-coat dark brown, ellipsoid, subangular, 10 x 5 x 3 mm, postchalazal vascular bundles observed; embryo widely ovate (Figure 33).

E. zeyheri is a relatively rare tree, only locally frequent in the Eastern Cape and some parts of KwaZulu-Natal. The known distribution in the Eastern Cape, KwaZulu-Natal and one locality in Mozambique near the Mpumalanga-Swaziland border has been extended considerably by Mr. S. Venter who discovered several new records in the Northern Province (Figure 38). Though listed as indeterminate in Hall *et al.* (1980), under the name *Cassine crocea auct*., there appears to be no need for any conservation status at present. Flowering October to April. Fruiting December to June.

In the Eastern Cape and Northern Province bark is extensively collected for medicinal and magical purposes (Vernon 1994; personal observations).

Until recently, the names *Crocoxylon croceum* (Robson 1965, 1966) or *Cassine crocea* (Arnold & De Wet 1993) have been widely applied to this species. Ecklon & Zeyher were not aware of the true identity of Thunberg's *Ilex croceum* when they published a taxonomic synonym, *Elaeodendron capensis*, in their *Enumeratio Plantarum*, but also chose the superfluous name *Crocoxylon excelsum* as the new name for *E. croceum*, therefore the type of *Crocoxylon* Eckl. & Zeyh. is *E. croceum*. The generic description of *Crocoxylon* and the two specimens cited in the *Enumeratio Plantarum*, however, clearly refer to the present species. This confusion has been perpetuated by most subsequent authors, adding to the confusion by misconstruing the characters and distribution of the two species (e.g. Von Breitenbach 1965, Coates Palgrave 1977). Most information in literature referring to *Cassine crocea* (hitherto often referred to as *Cassine papillosa*) is applicable to *Elaeodendron crocea* and not *E. zeyheri*.

Both manuscript names, *Salacia zeyheri* and *Rhamnus zeyheri* were presumably provided on duplicate specimens of a collection of Zeyher. Inexplicably, Harvey (1860) described *Salacia zeyheri* with flowers 4-parted, but with ovary trilocular and with three stamens in the treatment of Hippocrateaceae in Flora Capensis. This observation was confirmed by Sonder (1860) in the treatment of Celastraceae in the same volume of Flora Capensis. This particular specimen could not be accounted for, and is possibly aberrant (as suggested by Sonder (1860)). Sonder placed *E. zeyheri* as *C.* [*Cassine*?] *zeyheri* Turcz. under an inclusive *Elaeodendron croceum.*

Robson (1965, 1966) considered *E. zeyheri* and *E. transvaalense* as being sufficiently distinct from *Elaeodendron* due to their flowers with isomerous ovaries and stamens situated inside the disk to justify the segregate genus *Crocoxylon* Eckl. & Zeyh. Leaf margins of *E. zeyheri* are glandular-denticulate, never spinulose-denticulate, a condition often very marked in juvenile leaves of *Elaeodendron croceum.*

Selected specimens examined

Mozambique

—**2632** (Bela Vista): Goba, Fonte de Goba (–AA), *De Carvalho 654* (K).

South Africa

—**2329** (Pietersburg): Soutpansberg, Vivo, Farm of Mr Maggs, behind house (–AB), *Archer 482* (PRE); Houtboschdorp (–DD), *Venter s.n.* (PRE).
—**2430** (Pilgrim's Rest): Ofcolaco, rocky outcrop on riverbank (–AB), *Garlick 10* (PRE).
—**2731** (Louwsburg): Magut, 2 mile SW of Magut on W slopes of mountain (–DA), *Acocks 13027* (K, PRE).
—**2732** (Ubombo): False Bay Park (–CD), *Nichols 795* (NH, PRE).
—**2830** (Dundee): Muden, Mooi River (–CD), *Watt & Brandwijk 1476* (PRE).
—**2831** (Nkandla): 10 mile W Nkandla in Nsuzi River Valley (–CA), *Codd 1421* (PRE); Mpofu Game Reserve (–CD), *Mzazi PRE-60785* (PRE).
—**2832** (Mtubatuba): Mtubatuba, False Bay Sand Forest (–CD), *Lawson 155* (NH).
—**2930** (Pietermaritzburg): Greytown to Mooi River, 18 km (–AA), *White 10503* (NH, PRE); Tweedie, Ashley Grange (–CA), *Moll 953* (K, NH, PRE); Cato Ridge (–DA), *McClean & Ogilvie* (NH, PRE).

—**3127** (Lady Frere): Elliot, Bloemvlei on mountain slope (–BD), *Van Zinderen Bakker 66* (K, PRE).

—**3128** (Umtata): Engcobo, All Saints Nek, 2.2 mile from Engcobo (–CA), *Marais 503* (K, PRE).

—**3226** (Fort Beaufort): Pefferskop (–DB), *Acocks 8989* (PRE); Koonap Heights (–DC), *Britten 2055* (GRA, PRE); Alice, Mavuso Location, between location and town of Alice (–DD), *Gibbs-Russell 3929* (GRA, PRE).

—**3227** (Stutterheim): Fort Cunynghame (–AD), *Sim 2120* (BOL, GRA, PRE); Stutterheim, 8.4 mile from Stutterheim on Keiskamma Hoek road (–CB), *Marais 528* (GRA, K, PRE); Woods near Komga (–DB), *Flanagan 775* (GRA, PRE).

—**3324** (Steytlerville): Beans Bush, Patensie (–DD), *Bayliss BRI.B. 534* (PRE).

—**3325** (Port Elizabeth): David Birch, Farm Mimosa on Paterson Road to Addo (–BD), *Rippon PRE-644923* (PRE); Addo National Park, Zuurkop (–DA), *Hall-Martin 5959* (PRE).

—**3326** (Grahamstown): 19 mile from Fort Beaufort on Grahamstown road (–AA), *Marais 529* (BOL, GRA, K, PRE); Farm Groot Tootabi (–AC), *Archibald 5893* (GRA, PRE); Ecca River Valley, Glen Dew (–BA), *Taylor & Edwards 8791* (GRA, K, PRE); Grahamstown, 6–16 km from Grahamstown along Manley flats turnoff on East London road (–BC), *Jones PRE-57729* (K, PRE); Bathurst, Hopewell (–BD), *Acocks 12069* (PRE); Fonteinskloof, 27 km from Alexandria on road to PE (–CA), *Burrows 2835* (GRA); Alexandria Forest (–CB), *Marais 540* (GRA, K, PRE); 1 mile E of Kariega River, road Southwell-Alexandria (–DA), *Acocks 12069* (GRA, PRE); Bathurst State Forest, Waters Meeting Nature Reserve (–DB), *Herman 865* (PRE).

—**3327** (Peddie): East London (–BB), *Irving TRV-26234* (PRE).

8. Elaeodendron transvaalense (Burtt Davy) R.H. Archer, comb. nov. Type: Transvaal, Lydenburg Distr., Sabie-hoek forest, *Burtt Davy 1699* (PRE!, holo?; BOL!).

Salacia ? transvaalensis Burtt Davy: 51 (1921). *Pseudocassine transvaalensis* (Burtt Davy) Bredell: 330 (1937); Loes.: 230 (1942b); Miller: 35 (1948); Pardy: 631 (1956); Boughey: 164 (1964); Gomes e Sousa: 499 (1967); Compton 338 (1976). *Crocoxylon transvaalense* (Burtt Davy) N. Robson: 41 (1965); 391 (1966); N. Robson & Sousa: 37 (1969); Mendonça & Sousa: 183 (1968); Roessler: 2 (1968). *Cassine transvaalensis* (Burtt Davy) Codd: 124 (1966); Palmer & Pitman: (1973); Van Wyk: 347 (1974); 147

(1984); Coates Palgrave: 513 (1977); Drummond: 128 (1981); Arnold & De Wet: 483 (1993); Pooley: 273 (1993).

Hippocratea seineri Seiner: 44 (1911), *nom nud.*

Elaeodendron croceum var. *triandrum* Dinter: 189 (1921), *nom nud.*

Elaeodendron croceum (Thunb.) DC. var. *heterophyllum* Loes.: 35 (1934). Type: Grootfontein, *Dinter 919* (SAM!, lecto., here designated).

Icones: Robson: 392, t. 83 (1966); Gomes e Sousa: t. 128 (1967); Van Wyk: t. 416 (1974); 147 (1984); Drummond: 129, t. 60 (1981).

Irregular shrub to tall rounded bush or tree; bark greyish, yellow pigment absent or hardly visible, rhytidome exfoliating in thin scales, surface deeply longitudinally fissured. *Branchlets* terete, greyish, lenticels inconspicuous. *Leaves* alternate, spiralled to clustered (fasciculate) or subopposite, often ternate at the apex; lamina elliptic to oblong to narrowly oblong, green to greyish green, (10–) 15–40 (–90) x (5–) 7–15 (–25) mm, base cuneate, apex rounded; margin entire to glandular-denticulate to spinulose-denticulate on juvenile shoots; coriaceous; venation ± raised above and below in dried material, fine reticulation less conspicuous, indistinctly brochidodromous; petiole 2–5 mm long; stipules brownish black. *Inflorescences* pedunculate, compact dichasial, axillary towards apices of branchlets, 3–10(15)-flowered, peduncle 4–10 mm long; bracts minute. *Flowers* bisexual, 3-merous, ± 6 mm in diam., pedicels 3–4 mm long. *Sepals* greenish, subcircular, 1.2 x 1.6 mm long, subcoriaceous, margin entire. *Petals* cream to green, oblong to obovate, 3–4 x 2.5 mm, sessile, spreading, apex rounded, margin entire, the lower half revolute, involute towards the apex (appearing spathulate), the lower half of the lamina thickened with projections towards the apex. *Stamens* initially erect, soon curving outwards with anthers almost touching sepals; filaments ± 1 mm long, arising from near centre of disc, anthers 0.4 mm long, extrorse. *Disc* entire, convex, thick and fleshy. *Ovary* 3-locular; style ± 0.4 mm long; stigma inconspicuous. *Fruit* drupaceous, spheroid to widely ellipsoid, cream or yellowish, drying dark brown, 10–15 mm diam., stone spheroid to broadly elliptic, surface smooth, 8–12 mm diam., 2 mm thick. *Seeds* 1 or 2(3) per fruit, seed-coat dark brown, ovoid, flattened, 8 x 5 x 2 mm; embryo ovate (Figure 34).

Elaeodendron transvaalense is widespread in southern Africa, being recorded from Zambia, Zimbabwe, South Africa, Swaziland, Namibia, Botswana and Mozambique (Figure 39) where it occurs in woodlands and bushveld, occasionally growing on termite mounds. In the KwaZulu-Natal bushveld it is particularly conspicuous. The Ingwavuma District in KwaZulu-Natal is named after the common Zulu name of the tree. Flowering December to April.

The bark of *E. transvaalense* is used extensively by the Zulu for stomach trouble and fever. On the Witswatersrand it is among the more popular items in trade on muti markets (pers. comm. V. Williams, Departmeny of Botany, University of the Witwatersrand). Palmer & Pitman (1973) provide a recipe, recounted by Father Gerstner, for a tea made of bark.

Elaeodendron transvaalense was placed in many genera, amongst others a genus of its own (*Pseudocassine* Bredell 1937). On account of its 3-merous flowers, unusual in the family Celastraceae, Loesener (1942b) placed this species as *Pseudocassine* in the Hippocrateaceae (a group with 3 stamens, although not 3-merous).

Selected specimens examined

Angola

—**1513**: Huila, Chibota, Tchivinguiro (–AB), *Gossweiler 12715* (BM, MO); Huila (–BA), *Dekindt 604* (P); Huila, Quihita, margens do Rio Caculuvar (–BD), *Barbosa & Moreno 10174* (PRE).

Zambia

—**1725**: King's Mile, Livingstone (–DB), *Brenan & Greenway 7790* (K).
—**1726**: Hunter's Rest Farm, on rd 347 (to Kabanga Mission) on Naruwamba stream (–BA), *Bainbridge 926* (K).
—**1228**: Kitwe (–CC), *Fanshawe 7691* (K).

Zimbabwe

—**1826** (Hwange): Main Camp, near Dopi, Wankie National Park (–DD), *Rushworth 1330* (K, PRE, SRGH).

—**1830** (Hartley): Hartley, Poole Farm (–AB), *Hornby 3382* (K, SRGH).

—**1832** (Mutare): Rusape, Valhalla (–CB), *Dehn R8* (K); Umtali, Commonage (–DC), *Chase 5958* (BM, K, PRE, SRGH).

—**1929** (Gweru): Gwelo, 6 mile S of Gwelo (–BD), *Biegel 1952* (K, PRE, SRGH).

—**1930** (Mvuma): 2 mile from Lalapanzi on Gwelo road (–AC), *Mullin 11/51* (MO); Umvuma Golf Course (–BC), *Hodgson 3/50* (K, PRE, SRGH); Selukwe, Gwenoro Dam near spillway, south end (–CA), *Biegel 2602* (K, SRGH).

—**2028** (Bulawayo): Bulawayo Hillside (–BA), *Hodgson 5/52* (K, PRE, SRGH); Essexvale (–BD), *Borle 87* (K, PRE); Matopos (–DA), *West 2172* (K, MO, PRE, SRGH).

—**2030** (Masvingo): [Fort] Victoria [Masvingo] (–BD), *Monro 588* (BM, K).

—**2130** (Nuanetsi): Nuanetsi, Matibi Reserve, Pamba Weir Sandveld (–BC), *Davies 2433* (K, MO, PRE, SRGH).

—**2132** (Massangena): Lundi area (–AC), *Mullin 98/51* (K, MO, SRGH).

Namibia

—**1714** (Ruacana Falls): Ruacana (–AC), *Kotze 15* (PRE).

—**1725** (Livingstone): Kazangula (–CC), *Van Rensburg 10486* (PRE).

—**1814** (Otjerunda): Kaokoveld, Farm Otjitundua (–CA), *Giess & Leippert 7346* (MO, PRE).

—**1817** (Tsintsabas): Tsumeb, Tsintsabis (–DB), *Marsh PRE-47212* (PRE).

—**1917** (Tsumeb): Grootfontein, Farm Heidelberg (–BB), *Walter 365* (B, PRE); Farm Kunkauas, road to Post Office (–CA), *Kinges 3016* (PRE).

—**1918** (Grootfontein): ± 80 km from Rundu, Farm Taranaki (–BA), *Burgoyne 3228* (PRE); Grootfontein, Venters Post (–CA), *Dinter 7388* (BM, BOL, K, PRE, Z).

—**1920**(Tsumkwe): Tsumkwe, Groot Dobe (–BC), *Botha & Bredenkamp 3592* (PRE); Barakapan-Wes (–DB), *Botha & Bredenkamp 3602* (PRE); 13 km E of Tsumkwe (–DC), *Giess, Watt & Snyman 11088* (PRE).

Botswana

—**1822** (Kangara): Okavango River, 16 km S of Samocina camp site (–CA), *Müller & Biegel 2292* (MO, PRE); Guma Lediba, W end near harbour (–CD), *Smith 1576* (K, MO, PRE).

—**1823** (Siambisso): Kwando River (–BC), *Smith 2343* (K, MO, PRE).

—**1824** (Kachikau): Serondela, Chobe River Bank (–BC), *Miller B/1131* (PRE).

—**1922** (Nokaneng): 'Blochage' Island Camp (–AB), *Smith 194* (K, LISC, PRE); Gomare, Toakhe River Bank (–AC), *Erens 258* (K, PRE); Mokolane, Central Thoage (–CB), *Smith 1488* (K, PRE).

—**2022** (Lake Ngami): Tsau, 13 km N of Tsau alongside Tsau-Nokaneng River road (–BA), *Smith 1456* (K, MO, PRE).

—**2023** (Kgwebe Hills): Maun (–AB), *Smith 1234* (K, MO, PRE); Botletle River, 1 km E of Samadupe Drift (–BA), *Biegel & Russell 3736* (LISC, MO, PRE, S).

—**2024** (Bushman Pits): Botletle River (–CB), *Erens 209* (K, PRE).

—**2124** (Rakops): Toromoja, (–BA), *Ngoni 425* (B, K, MO, PRE); Boteti River (–BA), *Smith 2545* (K, PRE).

—**2226** (Serowe): Metsimesau, Serowe (–BC), *Miller B/224* (PRE).

Mozambique

—**2433** (Chibuto): Gaza, Caniçado, andados 43 km de Mapulanguene para Massingir (–AC), *Correia & Marques 873* (LISC, PRE).

—**2532** (Maputo): Lourenco Marques, Magude (–BA), *Torre 7205* (K, LISC); Lourenco Marques, Matolla bridge (–CD), *Bremekamp LM56* (PRE); Maputo, Quinta da Pedra (–DC), *Gomes e Sousa 3658* (K, MO, PRE).

—**2632** (Bela Vista): Lourenco Marques, Umbelúzi, *Carvalho 998* (NBG); Maputo, near Changalane (–AC), *Torre 7926* (LISC); Lourenco Marques, near Porto Henrique (–BC), *Balsinhas 508* (BM, K, LISC PRE).

Swaziland

—**2631** (Mbabane): Tsanedi, SE side of town (–BA), *Van Jaarsveld 984* (K, NBG, PRE); Mbuluzi Private Nature Reserve, Umbuluzi Estates S of Viti's compound (–BB), *Culverwell 1347* (PRE); 5.5 mile NE of Mpaka Station, near S end of Hlane Wildlife Sanctuary (–BD), *Culverwell 812* (PRE); N of Ngwemphisi river, 4 km SE of Gebeni

Royal Kraal (–CB), *Prior 298* (PRE); Timbutini Hills (–DA), *Kemp 1461* (PRE); Stegi, Blue Jay Ranch (–BD), *Compton 32152* (PRE).

—**2632** (Bela Vista): Farm Mlawula, 2.5 mile S of Mlawula Station, W of Nkumbane Stream (–AA), *Culverwell 836* (PRE).

South Africa

—**2229** (Waterpoort): Foot of Wyllie's Poort (–DD), *Story 5953* (K, PRE).

—**2230** (Messina): Mutalerivier, bridge to Masisi (–BD), *Pienaar 1124* (PRE); Tate Vondo Forest Reserve, Dzanani, Deepkloof (–CC), *Hemm 257* (J, PRE).

—**2328** (Baltimore): Blauwberg, near Leipzig Mission Station (–BB), *Smuts & Pole-Evans 831* (BOL, PRE).

—**2329** Pietersburg): Brakrivier (–AA), *Mara Research Station* (PRE); 3 mile N of Bandolierskop (–BD), *De Winter & Killick 8907* (PRE); 5 mile S of Turfloop (–DD), *Thomas 58* (PRE).

—**2330** (Tzaneen): Ben Lavin Nature Reserve (–AA), *Ben Lavin Grp. A20* (PRE); 25 km from Gyani on the way to Punda Milia (–BC), *Van Wyk, Dahlgren & Kok 5467* (C, PRE, PRU); Hans Merensky Nature Reserve, Black Hill Dam (–DA), *Oates 246* (PRE); Phalaborwa, Letaba Ranch, (–DB), *Swart 77* (PRU).

—**2428** (Nylstroom): Melkrivier, 11 km vanaf Vaalwater op pad na Melkrivier (–AC), *Coetzee 996* (K, PRE); Zebediela, Farm Wildebeestlaagte (–AD), *Gilfillan sub Galpin 651* (PRE); Stepping Stones Farm, 26 mile NW of Naboomspruit (–BA), *Mogg 37397* (PRE); Warmbaths (–CD), *Balsinhas 3427* (BM, K, PRE); Naboomspruit, Mosdene (–DA), *Galpin 469M* (BM, K, P, PRE).

—**2429** (Zebediela): Swartkrans Area, Makapaan's Valley (–AA), *Balkwill & Balkwill 4419* (J); Sekhukuniland, Winterveld Farm (–CA), *Briers 42* (PRE); slopes between Magneethoogte and Schoonoord (–DD), *Maaren 20* (PRE).

—**2430** (Pilgrim's Rest): Swadini Nature Reserve, near dam (–DB), *Retief, Reyneke, Coetzer & Reid 1140* (PRE).

—**2431** (Acornhoek): Umbabat Bushveld E of Klaseri (-CA), *Shackleton 580* (J); Kruger National Park, 9 mile W of Skukuza (–DC), *Codd & De Winter 5130* (K, PRE).

—**2529** (Witbank): Loskop dam (–AD), *Mogg 30421* (J, K, PRE).

—**2531** (Komatipoort): Kruger National Park, Shabin (–AA), *Van der Schijff 702* (K, PRE); Kruger National Park, Nahpe (–AB), *Van der Schijff 3875* (K, MO, PRE); Komatipoort, Lekasi Bantutown (–AC), *Nel 382* (K, MO, PRE); Lebombo Mountains, Avondstonde plaas by Transvaalse grens tussen Komatipoort en Squamans (–CA), *Coetzee 1380* (K, MO, PRE); Kaap Muiden, Stentor (–CB), *Nel 342* (NBG, PRE); Wilsonskop, 8 mile SW of Hectorspruit (–DA), *Buitendag 965* (PRE); Farm Castellopoules between Komatipoort and Squamans (–DB), *Coetzee 1405* (PRE).

—**2628** (Johannesburg): Suikerbosrand, Nolte se kloof, Blesboklaagte (–CA), *Bredenkamp 430* (PRE).

—**2632** (Bela Vista): Ndumu, 2.5 km S of Ndumu store on Makane's Drift road (–CD), *Stephen 841* (K, MO, PRE).

—**2732** (Ubombo): Pongola Flood Plain (–AD), *Moll 5132* (PRE); Ubombo (–CA), *Gerstner 3777* (K, PRE); Makatini flats (–CD), *Herman 1022* (PRE).

—**2829** (Harrismith): Van der Merweskraal Farm, 9 mile E of Escourt (–DD), *Green 92* (PRE).

—**2830** (Dundee): *c.* 8 mile SE of Weenen (–CC), *Acocks 13862* (PRE); 4 mile from Muden (–CD), *Edwards 902* (PRE); Kranskop, 24 km from Kranskop on Nkandla road (–DD), *Hildyard 116* (C, K, PRE).

—**2831** (Nkandla): Mahlabatini (–AB), *Gerstner 4161* (BOL, GRA, K, PRE); 1 mile in Umfolozi Game Reserve toward Mpila woodland (–BB), *Moll 5246* (PRE); Umfolozi Game Reserve (–BD), *Bourquin 440* (PRE); Ian Scott-Barnes' Farm (–DB), *Moll 4959* (K, PRE).

—**2832** (Mtubatuba): Hluhluwe Game Reserve (–AA), *Stewart 280* (PRE).

—**2931** (Stanger): Mapumulo, Oqaqeni (–AA), *Edwards 1840* (K, PRE).

Figure 31. *Elaeodendron croceum.* Fruiting branch. *Archer 2090* (PRE).

Figure 32. *Elaeodendron matabelicum.* Flowering branch. *Norrgram 208* (S).

Figure 33. *Elaeodendron zeyheri.* Fruiting branch. *Marais 529* (PRE).

Figure 34. *Elaeodendron transvaalense*. Fruiting branch. *Archer s.n.* (PRE).

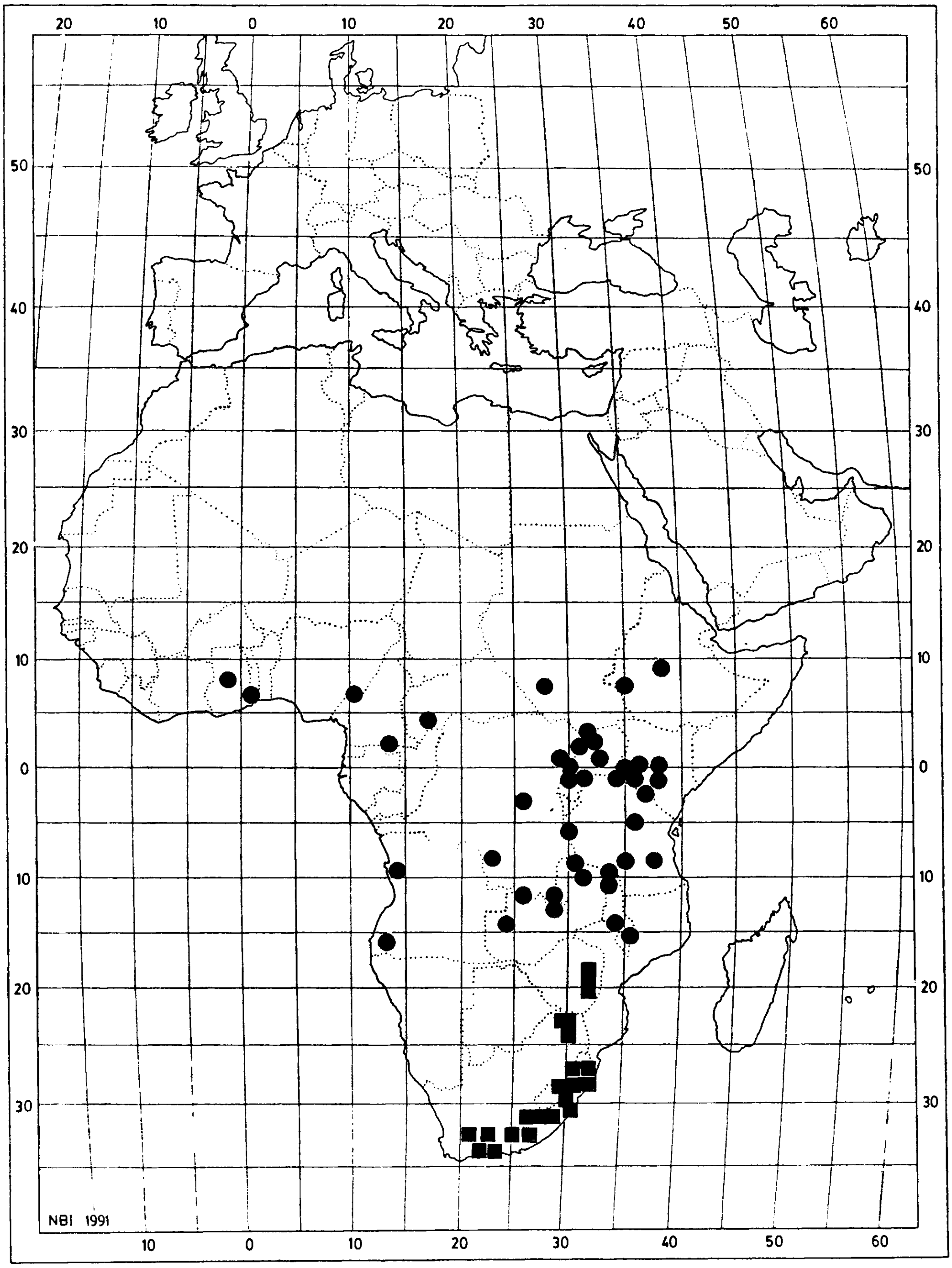


Figure 35. Known distribution of *Elaeodendron buchananii* ●, *E. croceum* ■.

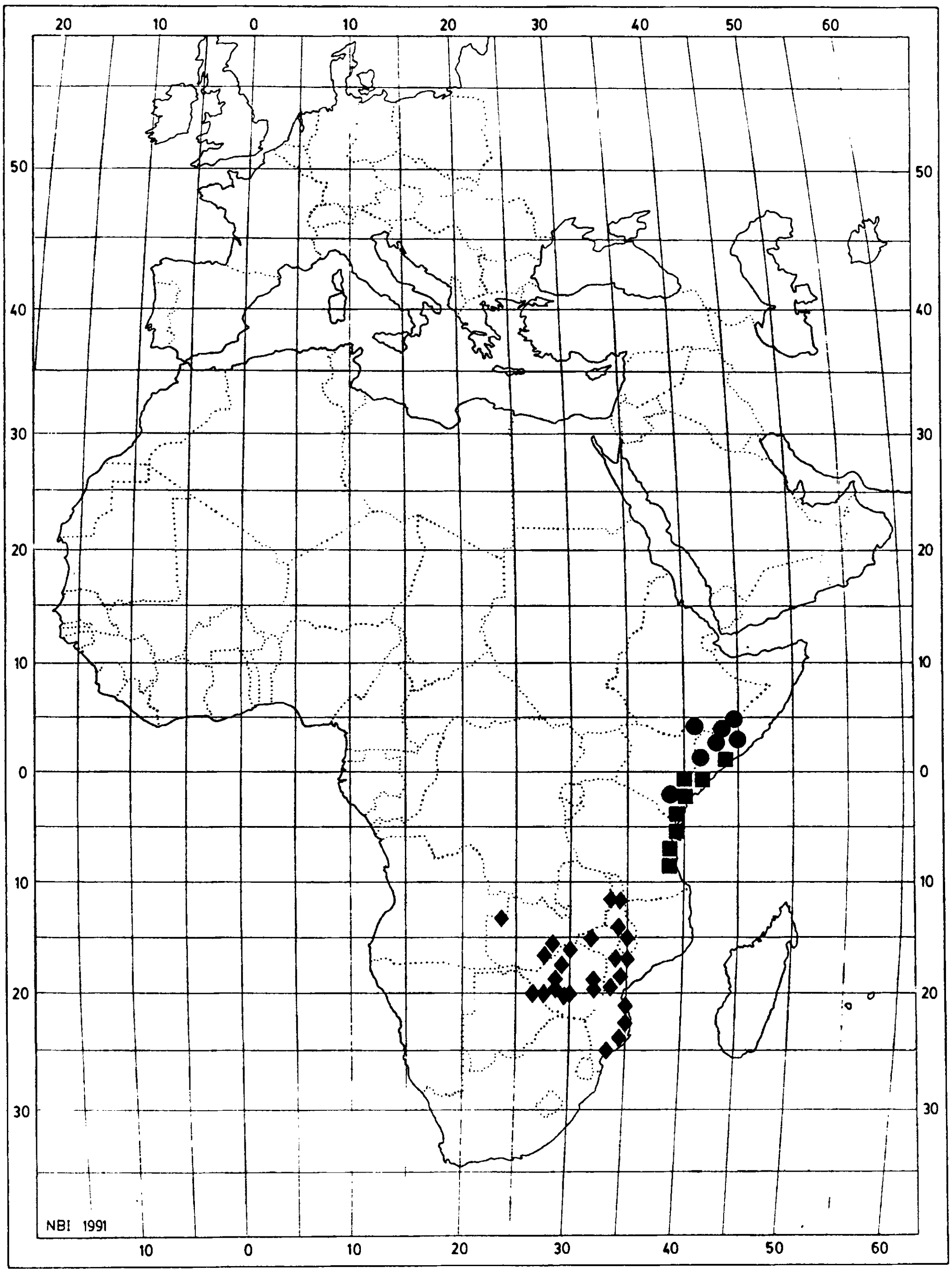


Figure 36. Known distribution of *Elaeodendron schweinfurthianum* ■, *E. aquifolium* ●, and *E. matabelicum* ◆.

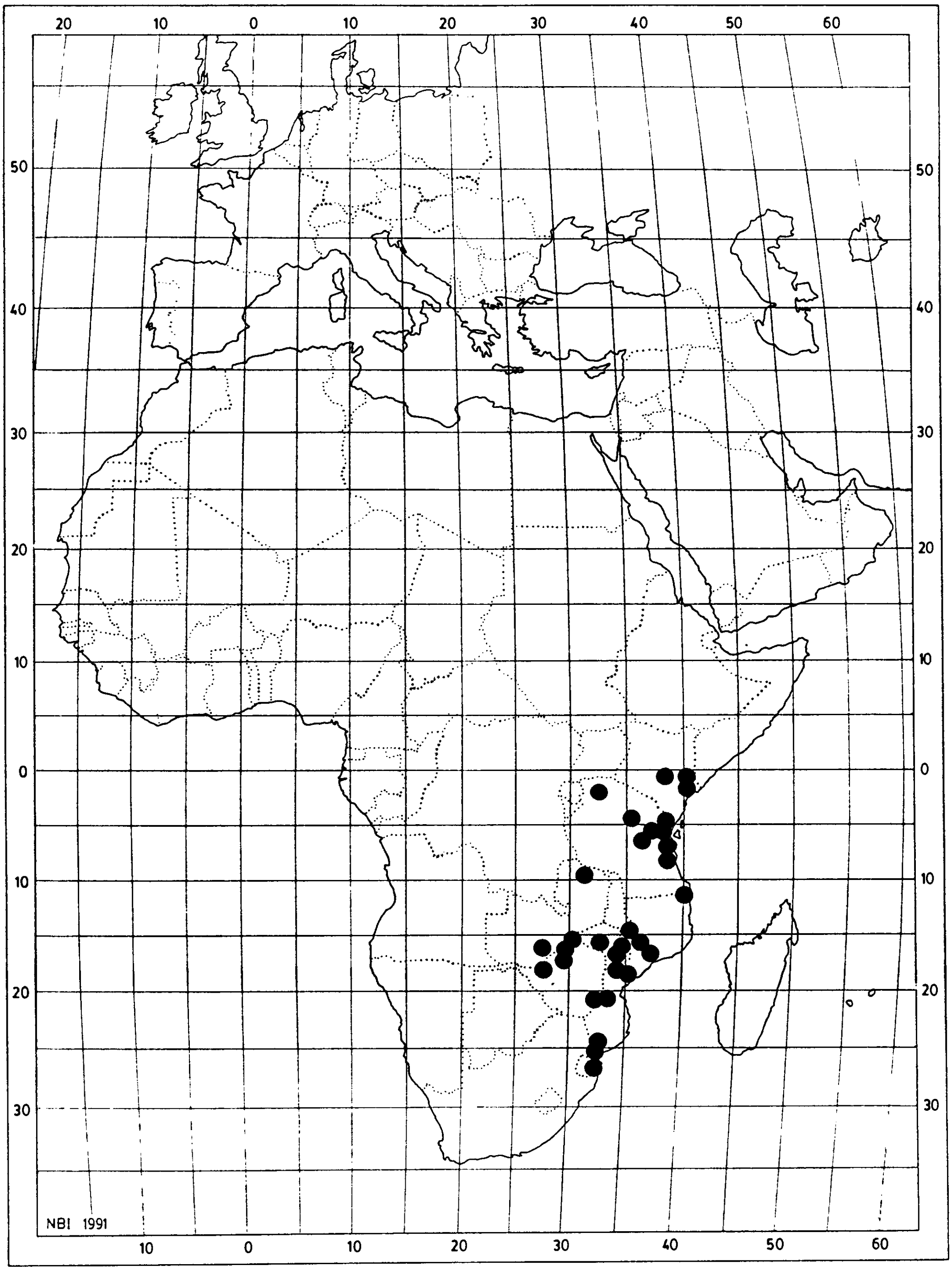
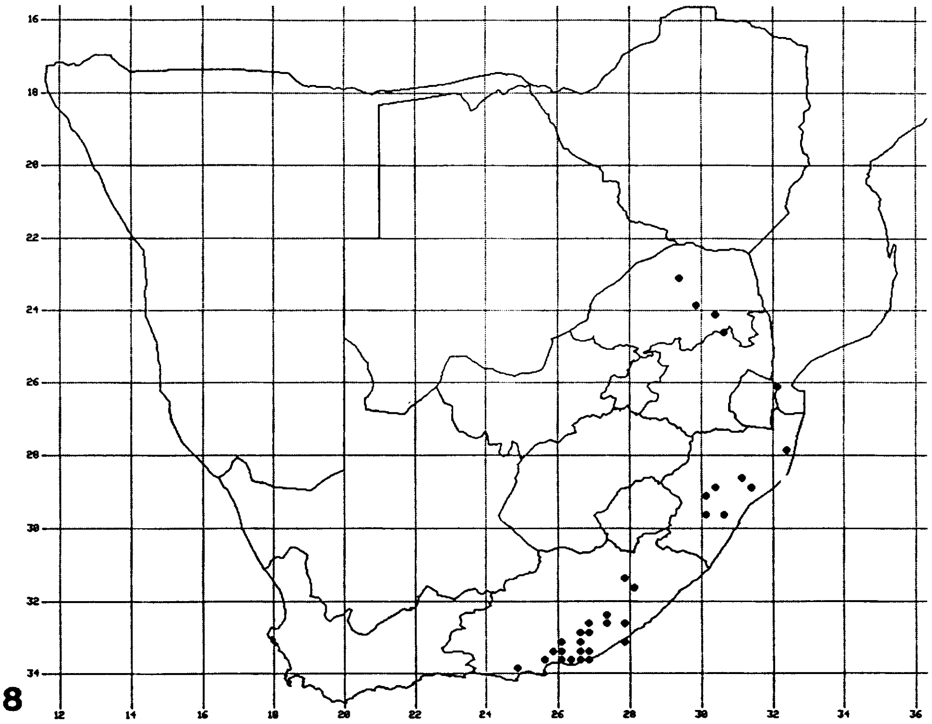


Figure 37. Known distribution of *Elaeodendron schlechterianum*.



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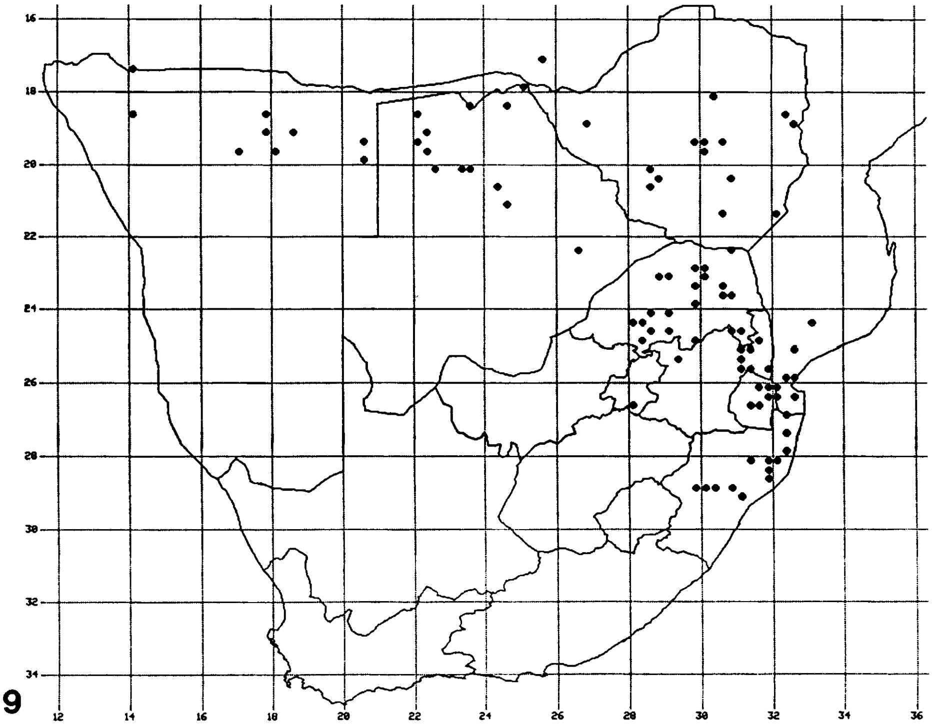

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Figures 38 & 39 Known distribution of *Elaeodendron* spp. **38.** *E. zeyheri.* **39.** *E. transvaalense.*

5.8 *PLEUROSTYLIA* WIGHT & ARN.[*]

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A taxonomic revision of *Pleurostylia* Wight & Arn. (Celastraceae) in southern Africa

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A taxonomic account is given of the genus *Pleurostylia* Wight & Arn. in southern Africa. The genus is represented in southern Africa by a widespread species *P. capensis*. *P. africana*, a tropical African species, does not differ significantly from *P. capensis* and is sunk. Notes on an uncertain species, *P. opposita*, on the coast of Mozambique is presented.

Introduction

In the Cassinoideae, *Pleurostylia* is characterized by a one-locular ovary (one locule apparently not developing), and a dry leathery fruit with remains of the style laterally displaced. The generic name refers to this character. Three to five species, some variable and needing taxonomic attention, are widespread in Africa, the Mascarenes and Australasia. Another species confined to tropical African is *Pleurostylia serrulata* Loes. from Cameroon (Villiers 1975). This species is at first sight atypical of the genus. Only two species have been recorded for southern Africa.

Taxonomy

Pleurostylia Wight & Arn. in Prodromus florae peninsula Indiae Orientalis 1: 157 (1834); Davison: 342 (1927); Loes.: 180 (1942a); N. Robson: 381 (1966); N. Robson *et al.* 27 (1994). Type: *Pleurostylia opposita* (Wall.) Alston, designated by Loesener: 180 (1942a) as *P. wightii* Wight & Arn.

*Cathastrum*Turcz.: 448 (1858). Type: *Pleurostylia capensis* (Turcz.) Loes.

Tree or shrub, unarmed, glabrous, without elastic threads in leaves and bark. *Leaves* opposite; lamina broadly elliptic, elliptic, ovate to lanceolate, base acute to acuminate, apex rounded to slightly obtuse or acuminate, margin entire, coriaceous; venation usually conspicuous; petiolate; stipules minute, ± triangular, brown, marcescent. *Inflorescences* pedunculate, compact dichasial, axillary; bracts minute. *Flowers* bisexual, (4-)5-merous, pedicellate. *Sepals* greenish, subcircular to depressed ovate, margin fringed. *Petals* greenish white, ovate, sessile, margin entire, apex rounded. *Stamens* erect, inserted in sinuses in margin of disc; anthers dorsifixed, introrse. *Disc* subangular, with sinuses at the point of stamen insertion, flat. *Ovary* ± ¼ immersed in and adnate to the disc, 2-locular, one infertile, with 2, 3 or 4 erect collateral ovules per locule; style short; stigma discoid, style and stigma occupying a lateral position on growing fruit due to development of one locule only. *Fruit* drupaceous, ± ellipsoid with scar of stigma on one side below the middle, pericarp thin, leathery, ± 1 mm thick, with fibrous bands arranged lengthwise on inside of pericarp. *Seeds* dark-brown, ellipsoid, elliptic to broadly-elliptic, postchalazal vascular bundles not observed, fleshy endosperm present; embryo erect, cotyledons fleshy.

Key to the southern African species

Leaves lanceolate, elliptic to broadly elliptic to ovate, apex slightly acuminate or obtuse, venation conspicuous; widepread in southern and tropical Africa. .... 1. *P. capensis*

Leaves elliptic, to broadly elliptic, ovate or obovate, apex obtuse or rounded, venation less conspicuous; recorded only from the coast of Mozambique. ..... 2. *P. opposita*

1. ***Pleurostylia capensis*** (Turcz.) Loes. in Engl. & Prantl., Natürlichen Pflanzenfamilien 3, 5: 216 (1892); Oliv.: 23 (1894); Sim: 183 (1907); 98 (1921); Davison: 343 (1927); Loes.: 180 (1942a); Von Breitenbach 644 (1965); Palmer & Pitman: 1327 (1973); Coates Palgrave: 516 (1977); Pooley: 280 (1993). Type: Without locality, *Ecklon, Celastr. no. 2.* (S!, holo.; MEL!, P!, indicated as Drége).

Cathastrum capensis Turcz.: 31 (1858); Sond. [with note by Harv.].: 526 (1860b).

Pleurostylia africana Loes. 311 (1908); 180 (1942a); Brenan & Greenway: 129 (1949); Wilczek: 132 (1960); Dale & Greenway: 138 (1961); White: 219 (1962);

Boughey: 163 (1964); N. Robson: 383 (1966); N. Robson & Sousa: 31 (1969); Beentje: 343 (1994); N. Robson *et al.:* 27 (1994); Coates Palgrave: 516 (1977); Troupin: 207 (1982); 322 (1983). Type: Nyassaland [Malawi], without locality, *Buchanan 272* (K!, lecto., here designated).

Pleurostylia heynei var. *acutifolia* Suesseng.: 110 (1953). Type: Zimbabwe, Marandellas, Willowkopje, *Dehn 724/1941* (M, holo.).

Pleurostylia africana Loes. var. *lindiensis* Loes. *nom nud., tantum in scheda.*

Icones: Sim: t. 123 (1907); Davison: t. 14 (1927); Robson: 384 (1966); Robson *et al.* 28 (1994).

Small to large tree up to 20 m high, unarmed, glabrous; bark greyish, smooth in young stems or deeply fissured in large prominent, ± square pattern, with layers of powdery orange pigment in exposed rhytidome. *Branchlets* ± square, 4-lined, becoming terete, greyish brown. *Leaves* strictly opposite; lamina lanceolate, elliptic, broadly elliptic to ovate, bluish-green, glossy green or greyish-green, (15–) 25–65 (–85) x (6–) 15–30 (–35) mm, base acute to acuminate, apex rounded or slightly obtuse, or acuminate, margin entire, coriaceous; venation (including reticulation) conspicuous on both sides, brochidodromous; petiole 2–8 mm long. *Inflorescences* pedunculate, compact dichasial, 1–10 flowered, peduncle 2–8 mm long; bracts minute. *Flowers* bisexual, 5-merous, ± 4 mm diam.; pedicels 1.0–1.5 mm long. *Sepals* greenish, subcircular to depressed ovate, ± 0.5 x 1.0 mm, margin fringed. *Petals* greenish white, ovate, ± 1.5 x 1.0 mm, sessile, apex rounded, margin entire, erect to subspreading. *Stamens* erect; filaments ± 1 mm long, inserted in sinuses in margin of disc; anthers ± 0.7 mm long, dorsifixed, introrse. *Disc* subangular, with sinuses at the point of stamen insertion, flat. *Ovary* ± ¼ immersed in and adnate to disc, 2-locular, one infertile, with 2, 3 or 4 erect collateral ovules per locule; style ± 0.25 mm long; stigma discoid, style and stigma occupying a lateral position on growing fruit due to the development of one locule only. *Fruit* light brown, ellipsoid, scar of stigma on one side below middle, 5 x 8–9 mm, pericarp thin, leathery, ± 1 mm thick. *Seeds* dark-brown, ellipsoid, 5–6 x 2–4 mm, elliptic to wide-elliptic, postchalazal vascular bundles not observed, fleshy endosperm present; embryo erect, with cotyledons fleshy, wide-elliptic, base unequal (Figure 40).

Pleurostylia capensis is an attractive, rather uncommon tree. In South Africa few large trees remain due to felling, for example in the Blouberg, Northern Province and the Zuurberg, Eastern Cape. Sim (1907, 1921) noted that *P. capensis* is a large tree but too scarce to be used economically. The wood is pale brown with a pinkish tinge, hard and strong, and was once used for making wagon wood (Palmer & Pitman 1973). Vernacular names are 'Coffee pear', 'Koffiepeer' or 'Mountain hard pear'. It occurs in the eastern parts of Africa from the Cape to Uganda (Figure 41).

Pleurostylia capensis and *P. africana* have until now been kept apart on account of the number of ovules in the fertile locule; 6–8 and 2 or 3 respectively (Robson *et al.* 1994), and the distribution, southern Africa and tropical Africa respectively. Turczaninow (1858) originally described *C. capensis* as having 6 ovules. Harvey (1860b) described it with 6–8 ovules. This figure was cited in most subsequent literature, with the exception of Von Breitenbach (1965), who cited 3–4 ovules for *P. capensis*. I found 2–4 ovules in all the flowering material dissected (with the exception of the type, which was examined only superficially).

It was once thought that the presence of a characteristic yellow pigment in the bark of *P. capensis* distinguishes it from *P. africana*. However, at least three herbarium specimens from Malawi, Zaire and Kenya have samples of bark with yellow pigment, or the presence of yellow pigment is recorded on the label notes. Another distinction based on the shape of the leaf apex is not consistent. The two species are so closely related in all aspects that it is impossible to keep them apart.

Robson (1966, 1994) cited *Buchanan 272* (B) as the holotype of *Pleurostylia africana*, but this is incorrect since two syntypes were cited by Loesener (1908). The only extant specimen available is here designated the lectotype of *P. africana*.

Selected specimens examined

Uganda

—**01N33E**: U3, Usuku, Teso Mt. Abela [Abela Rock], SW of Katakwi (–BB), *Katende & Lye 5422* (UPS).

Kenya

—**0240**: K7, Lamu, Ras Teweni (–BD), *Luke & Robertson 1429* (MO).
—**0439**: K7, Diani Forest, N of turn off from new road for Jadini hotel (–BC), *Gillett & Kibuwa 19862* (MO).

Zaire

—**1127**: Near Elizabethville, Ruigvel[t] (–CB), *Burtt Davy 18133* (K); Munama (–DC), *Malaise 13716* (C, K, PRE, UPS).

Tanzania

—**0332**: T4, Kahama (–DC), *Burtt 5463* (BM, S).
—**0333**: Shinyanga (–CD), *Burtt 5584* (BM, S).
—**0434**: T4, Singida Distr. (–DA), *Burtt 5223* (BM, PRE, S).
—**0735**: T7, Iringa, Kihesa Village (–DA), *Mhoro 2850* (MO).
—**0736**: T7, Iringa, Distr. Kidatu (–DB), *Mhoro 261* (UPS).
—**1038**: Masasi Distr., 8 km NE of Masasi, Mkwera Hill (–DB), *Bidgood, Abdallah & Vollesen 2014* (C).
—**1039**: T8, Lindi-Bez, Muera Plateau (–AB), *Schlieben 5901* (BM, PRE).

Malawi

—**1133**: Mzimba, 11 mile NE of Mzambazi on S49 (–DC), *Pawek 13679* (MO, PRE).
—**1333**: Dowa, 2 mile W of Lake Nyasa Hotel (–DB), *Chase 3880* (BM, K, MO).
—**1334**: Between Lake Nyassa and Grand Beach Hotels, near Salima (–CD), *Robson & Steele 1622* (BM, K, PRE).
—**1434**: Dedza, slopes of Chongoni Mountains (–AA), *Jeke 49* (K).
—**1535**: Mlanje Mountain, Chambe Peak (–DC), *Chapman 376* (BM, K).

Zambia

—**1124**: Mwinilunga, 1 mile S of Matonchi Farm (–CA), *Milne-Redhead 4481* (BM, K, PRE); Mwinilunga, 4 mile S of Mwinilunga (–CB), *Milne-Redhead 3508* (BM, K, PRE).
—**1131**: Mpika (–DC), *Fanshawe 1910* (K).

—**1227**: Chingola (–DB), *Fanshawe 3337* (K).

—**1228**: Kitwe (–CC), *Fanshawe 11327* (K, UPS); Ndola (–DC), *Fanshawe 501* (K).

—**1323**: Balovale (–CA), *Gilges 315* (K).

—**1527**: Mazabuka, Yates Jones Farm near Choma (–DD), *White 6487* (K).

—**1626**: 10 mile NE of Siachitema Mission, SW of Kalomo Hills (–CD), *Bainbridge 920* (K).

—**1725**: 1 mile above Victoria Falls (–DD), *Hutchinson & Gillett 3424* (BM, K).

Zimbabwe

—**1628**: Urungwe, Kariba (–DB), *Goldsmith 3/59* (BM, K, S, SRGH).

—**1631**: Darwin, SE corner of Chiswiti Reserve (–BC), *Phipps 2476* (K, MO, PRE, SRGH).

—**1826** (Hwange): Hwange, Maletsi Safari Area Headquarters (–AC), *Gonde 415* (S, SRGH, UPS).

—**1829** (Kwekwe): Que Que, Sable Park (–DD), *Chipunga 147* (MO, SRGH).

—**1830** (Hartley): Poole Farm Hartley (–AB), *Hornby 3428* (MO, SRGH); Enterprise, Ewanrigg Farm (–CB), Eyles 5602 (SRGH); Charter, Featherstone Kopje (–DB), *Wormald 48/51* (MO, PRE, SRGH).

—**1831** (Marondera): Marandellas, Willowkopje (–BA), *Dehn 724/1952* (K, MO, SRGH).

—**1832** (Mutare): Rusape, Valhalla (–CA), *Dehn 724/53* (K, SRGH); 45 km N of Mutare on the rd to Juliusdale (–DA), Van Wyk BSA 1898 (PRE, PRU); Honde Valley, mountain forest edge (–DB), *Gilliland K1318* (BM, K).

—**1931** (Buhera): Buhera (–AD), *Davies 610* (K, MO, SRGH).

—**1932** (Melsetter): Umtali, Umtali Golf course (–BA), *Chase 4257* (BM, K, PRE, SRGH); Umtali, Impodzi River (–BC), *Chase 284* (BM, K).

—**2032** (Chipinge): Inyanga, Chikore Reserve (–BC), *Masterson 215* (PRE, SRGH).

Mozambique

—**1335**: Marrupa, Lichinga (–AD), *Nuvunga 539* (NBG).

—**1337**: Marrupa, arredores da Vila, *Nuvunga 485* (K).

—**1534**: Moatize, Zóbuè (–CB), *Correia 347* (K).

—**1536**: Zambesia, Guruè, Lioma (–BB), *Torre 5645* (K).

Angola

—**1513**: Moçamedes, Vila Arriaga, [Fazenda]Chão da Chela (–AA), *Mendos & Santos 1467* (PRE).

South Africa

—**2328** (Baltimore): Blauberg, near Leipzig Mission Station (–BB), *Codd 8721* (PRE).
—**2329** (Pietersburg): Blouberg Mountain (–AA), *Archer 469* (PRU); Vivo, Soutpansberg, Farm Llewllyn 35 MS (–AB), *Venter 11972* (PRE); Pietersburg, 10 km to Tzaneen (–DC), *Archer 333* (PRU).
—**2429** (Zebediela): Swartkrans Area, Makapaans's Valley (–AA), *Maguire 2785* (J, PRU).
—**2529** (Witbank): Loskopdam, Nooitgedaght, Diepkloof (–AD), *Theron 1418* (PRE, PRU).
—**2530** (Lydenburg): Buffelskloof Nature Reserve, Horshoe Gorge Trail (–AB), *Burrows 4050* (J, MO); Farm 'Jespea', Schagen, river bank (–BC), *Onderstall 275* (NBG, PRE).
—**2631** (Mbabane): Top of Lebombo range at Stegi (–BD), *Acocks 15349* (PRE); Ravelston (–DD), *Keith PRE-47260* (PRE).
—**2632** (Bela Vista): Jilobi Forest, 28 km SE of Siteki (–CA), *Kemp 1331* (PRE).
—**2731** (Louwsburg): Itala Nature Reserve, near square davel (–CB), *MacDevette 2182* (PRE).
—**2732** (Ubombo): Gwalaweni Forest (–AC), *Moll 5639* (K, PRE); On way from Ubombo Magistracy to Ugaza Mountain (–CA), *Gerstner 4548* (PRE).
—**2828** (Bethlehem): [Royal] Natal National Park, Sundays River Forest (–DB), *Edwards 501* (PRE).
—**2829** (Harrismith): E end of Draycott Hill (–DC), *Acocks 11509* (PRE).
—**2830** (Dundee): Farm 'Selbourne' 12 mile E of Escourt (–CC), *Green 113* (PRE); 4 mile from Keate's Drift, on Tugela Ferry rd (–DC), *Edwards 2529* (PRE).
—**2832** (Mtubatuba): Dukuduku, Futululu (–AC), *Strey 6111* (K, PRE, S).
—**2931** (Stanger): Harold Johnson Reserve, picnic site (–AB), *Nichols 859* (K, PRE)
—**3028** (Matatiele): Amanzamnyama forest (–DD), *Niblock-Stuart FD-3098* (PRE).
—**3029**(Kokstad): Umtamvuna Valley, between Izingolweni and Bizana (–DD), *Acocks 13357* (PRE).

—**3030** (Port Shepstone): Oribi Gorge Nature Reserve, Mfezi Point Trail (–CA), *Balkwill 330* (PRE); Oribi Nature Reserve (–CB), *Moll 5018* (K, PRE); Umtamvuna Nature Reserve, Smedmore (–CC), *Abbott 4044* (PRU); River bank below Izotsha Falls (–CD), *Nicholson 706* (PRE).

—**3129** (Port St Johns): Intafufu (–DD), *Cooper 91* (PRE).

—**3130** (Port Edward): Umtamvuna Nature Reserve, Smedmore Forest (–AA), *Abbott 4249* (PRU).

—**3225** (Somerset East): Commando Drift Dam Nature Reserve, 40 Km E of Cradock (–BB), *Palmer 438* (GRA).

—**3226** (Fort Beaufort): Endwell, above Kroomie (–CB), *Acocks 23878* (PRE); Streambank Forest at foot of Amatolas on Hogsback - Alice Road (–DB), *Wells 3660* (GRA, K, PRE); Fort Beaufort, Gcato [Seymour] (–DB), *Wells 3852* (GRA).

—**3227** (Stutterheim): Boma Pass, 3.4 mile from Keiskammahoek (–CA), *Wells 3799* (GRA, PRE); Keiskammahoek (–CA), *Stayner 51* (GRA, PRE); Cata Forest Kologha (–CB), *Hutchins 915* (BOL, GRA, K, PRE, UPS); Perie Forest (–CC), *Hutchins 945* (PRE); Woods near Komga (–DB), *Flanagan 623* (BOL, GRA, K, NBG, PRE); Bonza Bay 10 mile E of East London (–DD), *Story 4487* (BM, BOL, K, MO, PRE, S).

—**3228**(Butterworth): Willowvale (–AD), *Acocks 12277* (PRE); Kentani (–CB), *Pegler 857*, (BM, BOL, K, PRE); Cefane R. (–CC), *O'Callaghan 1019* (GRA).

—**3325**(Port Elizabeth): Zuurberg National Park (–BC), *Archer 304* (PRU); Zungarivier bokant Groendaldam (–CA), *Geldenhuys 1227* (PRE); Loerie, beside road to Ede Hill Farm, on Old Loerie road (–CC), *Nel s.n.* (GRA).

—**3326** (Peddie): Bushman's River Poort [Bushman's Poort] (–AC), *Archibald 5609* (GRA, PRE); S side of Hills S of Coldspring (–AD), *Story 3203* (K, PRE); Andries Vosloo Kudu Reserve (–BA), *Palmer 442* (GRA); Trumpeters Drift near Peddie (–BB), *Bayliss PRE-1274* (PRE); Grahamstown, Wrest Hill (–BC), *Britten 2202* (PRE); Hopewell, Kariega Valley (–BD), *Acocks s.n.* (PRE); Alexandria, Balmoral Farm (–CB), *Hoole* GRA, PRE); Bushmans River Valley, Whitney (–DA), *Archibald 5788* (GRA, PRE); Gaga Valley, Stream near Ntsonas (–DD), *Giffen 1389* (GRA, MO, PRE).

—**3327** (Peddie): Line Drift (–AA), *Sim Galpin-6283* (PRE); Bawawoud naby Sandileskop, Isidenge Staatsbos (–CB), *Geldenhuys 727* (PRE).

2. ***Pleurostylia opposita*** (Wall.) Alston in Flora Ceylon 6, Suppl.: 48 (1931); Ding Hou: 288 (1962); N. Robson: 383 (1966). Type: *Wallich s.n.* (K).

Celastrus opposita Wall. in Roxb.: 398 (1824).

Pleurostylia wightii Wight & Arn. 157 (1834); Loes.: 180 (1942a). Type: India orientalis, *Wight 481* (K!, lecto., here designated; C!).

Icones: Robson: 384 (1966).

The Mozambique material of *Pleurostylia opposita* differs from *P. capensis* in its obtuse to rounded glaucous leaves and its whitish branches and fruit. Robson (1966) saw only one specimen from Africa and considered it very similar to *P. opposita* which occurs widely in Australasia and south-east Asia (Figure 41). The additional specimen seen from Mozambique is sterile, thus for a description refer to Robson: 386 (1966).

The remaining species of *Pleurostylia*, *P. leucocarpa* Bak., *P. pachyphloea* Tul. and *P. putamen* Marais (Tulasne 1857; Baker 1877; Marais 1981), from the Mascarene Islands are very similar and difficult to distinguish from *P. opposita* *P. putamen* was recently described (Marais 1981), unfortunately without any comparisons with the other species. A revision of all the species in the genus seems imperative.

Specimens examined

Mozambique

—**1738**: Pebane Beach (–AA), *Torre 4656* (LISC) *n.v.*
—**1935**: Beira, Cheringoma coastal area, 12 km from coast on Chinizíua Lighthouse road (–BA), *Tinley 2893* (K, PRE, SRGH).

Figure 40. *Pleurostylia capensis.* Fruiting branch. *Nichols 859* (PRE).

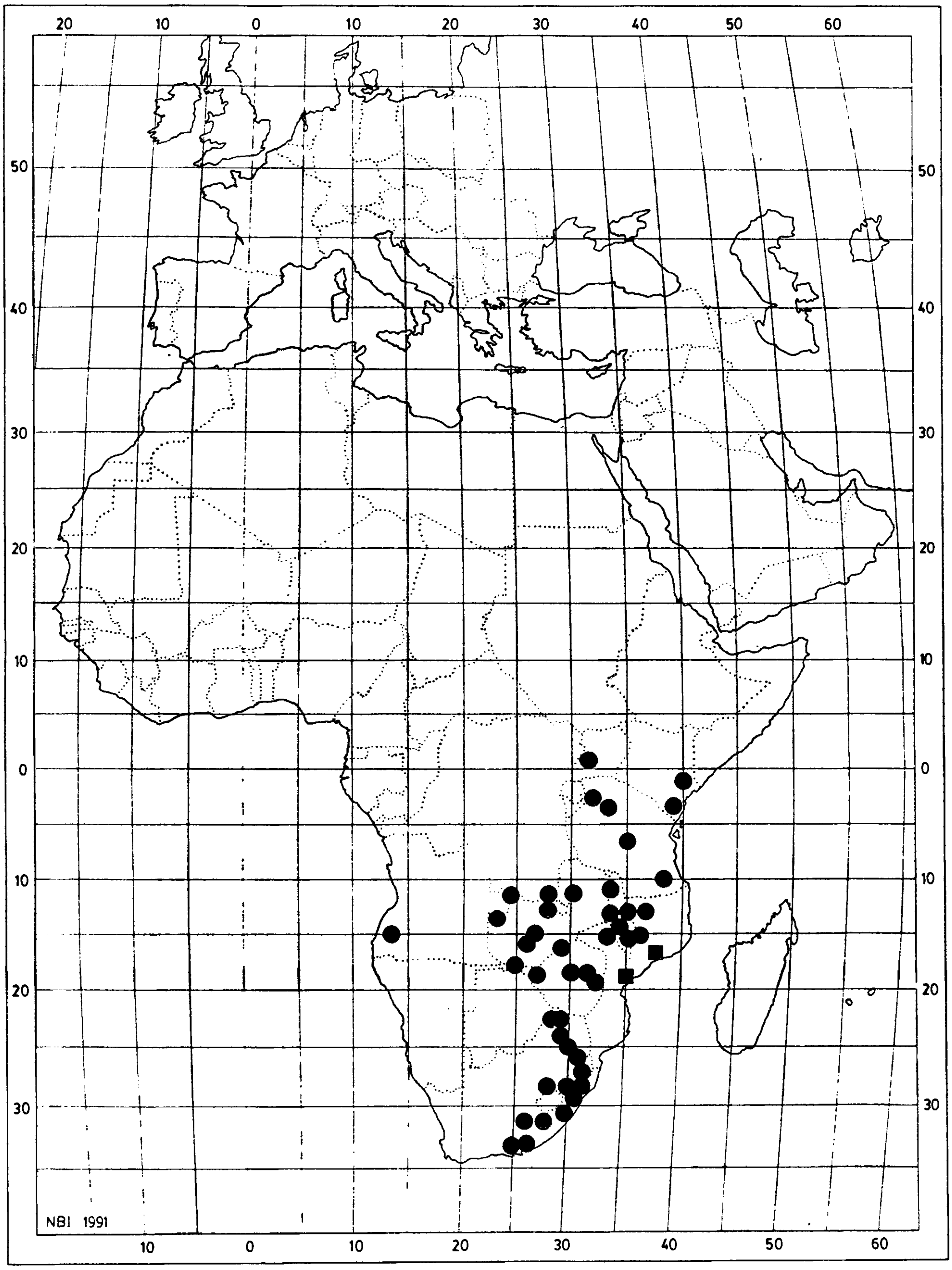

Figure 41. Known distribution of *Pleurostylia capensis* ●, and *P. opposita* ■, in Africa.

CHAPTER 6

GENERAL DISCUSSION

This study is a step closer to the goal of a complete revision of the southern African Celastraceae. It is hoped that this study will not only contribute towards a better understanding of the local taxa, but will also provide guidelines for similar studies on members of the Celastraceae in other parts of the world. The family is regarded as taxonomically difficult because of the limited number of morphological diagnostic characters that could be employed up to now (for example the flowers of many Celastraceae are very small and look fairly similar). The inconsistent application of characters has contributed to conflicting opinions regarding the generic limits of the southern African Cassinoideae. In fact the taxonomic history of the whole family shows an extensive lumping of different unrelated groups, or an extreme splitting of related groups. These classifications often follow dicta or personal preferences of prominent taxonomists, often without real justification. Apart from *Cassine s.l.,* the treatment of at least two groups is still controversial, *Maytenus versus Gymnosporia*, and *Hippocratea versus* a number of small segregate genera.

Several anatomical features, notably wood and bark structural types, and the presence of leaf epidermal crystals, stomatal types as well as pollen types, provide unequivocal taxonomic criteria for distinguishing between a number of supraspecific taxa in the southern African Cassinoideae. The fact that this evidence correlates closely with the findings of macromorphology, is seen as strong additional support for the validity of the proposed generic classification in this study. This considerable amount of taxonomically significant morphological and anatomical variation found in the single genus, *Cassine* as generally applied up to now, is certainly unusual and provides strong justification for the segregate genera recognized here. The comprehensive key provided in the Taxonomic treatment largely summarises the diagnostic characters of the genera.

One new genus, *Robsonodendron,* is proposed for two southern African species which were previously included under either *Cassine* or *Mystroxylon.* Three genera, *Elaeodendron*, *Mystroxylon*, and *Lauridia* are reinstated for the FSA region. *Hartogiella* is sunk under *Cassine* which is now restricted to southern Africa only. The present position of *Allocassine* and *Maurocenia* remains unchanged.

The variation within the *Mystroxylon aethiopicum* complex encountered over the whole of tropical and southern Africa and the Mascarenes is astonishing. I have succeeded only in providing a preliminary classification for the southern African area. More fieldwork and herbarium studies on *Mystroxylon aethiopicum* should be conducted. I believe that it should be possible to give formal taxonomic recognition to some of the various forms. In this study I have given subspecific, rather than varietal rank to the forms of *Mystroxylon aethiopicum* in southern Africa and to those of *Cassine peragua.* Most subspecies are well defined geographically and in most cases can be separated by three or more distinguishing characters.

With the exception of the *Mystroxylon aethiopicum* and *Cassine peragua* complexes, few taxonomic problems at species level have been encountered. The various species are well-defined entities although difficulties may arise, especially when identifying dried sterile material of some species. *Lauridia tetragona* displays considerable variation in habit and leaf morphology over its range, but it proved impractical to distinguish any infraspecific taxa.

The number of monotypic genera or genera with only two or three species is relatively high in the Celastraceae. Therefore the many monotypic or small genera maintained in this study conform to the general pattern in the family. It is postulated that the family is an old one and that these small genera represent ancient relicts.

Suprageneric groups

Loesener (1942a) established two tribes in the Cassinoideae on the basis of, amongst others, fruit. All the southern African Cassinoideae were placed in the tribe Eucassineae, i.e. having drupaceous fruit. The tropical genus *Perrottetia* with berries was placed in a tribe of its own, Perrottetieae. However, this classification has been disregarded in this study, because in reality the southern African genera can be divided into two groups, those with berries and those with drupes.

Brizicky (1964) considered the mainly tropical American *Tetrasiphon* Urban and *Gyminda* Sargent to be closely related to *Maurocenia* and *Cassine*. The first three genera differ from the other Cassinoideae and most Celastraceae in having pendulous, not erect ovules. Detailed comparison of the southern African taxa with the other members of the Cassinoideae seems to be vital for a better understanding of the phylogeny of the subfamily. Fruit morphology may indeed be significant in a suprageneric classification of all Cassinoideae. Furthermore, indications are that this subfamily might be a heterogeneous assemblage of genera of which some are more closely related to genera in other subfamilies. There is clearly a need to study the subfamilies from a worldwide perspective and preferably cladistically.

Archer (1990) and Archer & Van Wyk (1993a) considered the presence of styloid crystals and latex threads (polyisoprene) in the phloem of the new genus *Robsonodendron* and some thornless species of *Maytenus* Molina to be an indication of some closer relationships between these taxa, which require further study. It is possible that the drupe of *Robsonodendron* represents a primitive (or advance?) state of the capsule of the *Maytenus acuminata* (L.f.) Loes. complex of four species. Similar comparisons can be made between *Mystroxylon* and other species of *Maytenus*, particularly *Maytenus peduncularis* (Sond.) Loes. These associations have been suggested by Robson (1965), but detailed comparisons have not yet been possible.

CHAPTER 7

CONCLUSIONS

- In southern Africa the subfamily Cassinoideae is now represented by eight genera, five of which are endemic to the region. Two genera, *Mystroxylon* and *Pleurostylia,* each comprise one or two species (with a number of varieties or subspecies) in the Mascarenes and Australasia respectively. *Elaeodendron* is the only cosmopolitan genus, with about 30 species distributed in Africa, Central America, Asia and Australasia.

- A classification of the southern African species is presented which is believed to be the closest possible to a natural classification.

- The findings of this study correspond closely with previously published work on Flora Zambesiaca and Tropical East Africa Celastraceae.

- The need for a monographic study of *Elaeodendron* is mentioned. The present concept of *Cassine s. str.* necessitates many name reversals to the original basionyms in *Elaeodendron* in other parts of the world. In a few cases the correct combinations do not exist. In some parts of the world numerous names exist for single widespread taxa.

- A suite of diagnostic characters important for generic classification in the Cassinoideae includes features of general anatomy, particularly that of wood, bark, leaf and fruit, as well as palynology. General macromorphological characters, such as general habit, leaf arrangement etc., provide good additional criteria for distinguishing between genera.

- Macromorphological characters considered most important in this study at the specific or infraspecific level include characters of flower morphology (e.g. the number of parts) and leaf morphology (e.g. the shape of the lamina and margin).

- No phylogenetic analysis of the group is attempted. Due to the lack of knowledge of related Cassinoideae from other parts of the world no phylogenetic group could be defined. A traditional morphologic-taxonomic approach was employed for the present revision.

- Finally, it is hoped that a multidisciplinary study of the entire Cassinoideae, as well as the other possible six subfamilies could be conducted and ultimately contribute towards an enquiry into the evolution of the family and the order Celastrales.

CHAPTER 8

SUMMARY

A TAXONOMIC REVISION OF SOUTHERN AFRICAN CASSINOIDEAE (CELASTRACEAE)

by

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PHILOSOPHIAE DOCTOR

The primary object of this study was to provide a taxonomic account of the southern African Cassinoideae. The Cassinoideae is one of at least seven subfamilies in the morphologically diverse family Celastraceae. Cassinoideae consists of ± 21 genera worldwide of which eight genera, treated here, occur in southern Africa.

There has been considerable diversity of opinion regarding the delimitation and recognition of genera among the species of *Cassine* L. *s.l.* Many authors advocated smaller, more homogeneous genera, while others preferred to treat *Cassine* in a wide sense, so as to include parts of *Allocassine* N. Robson, *Crocoxylon* Eckl. & Zeyh., *Elaeodendron* Jacq., *Lauridia* Eckl. & Zeyh. and *Mystroxylon* Eckl. & Zeyh. New evidence from morphology and anatomy, as well as other sources, has accomplished a better understanding of generic limits in the southern African Cassinoideae.

A classification of the southern African Cassinoideae, based on all available evidence, is presented. In this treatment, believed to be the closest possible to a natural classification, eight genera are recognized. Five genera, *Cassine s. str., Allocassine, Maurocenia* Mill., *Lauridia* and a new genus, *Robsonodendron,* are considered endemic to southern Africa. Two genera, *Mystroxylon* and *Pleurostylia,* comprise one species each in southern Africa but have an unknown number of taxa in the Mascarenes, Asia and Australasia. *Elaeodendron* is the only cosmopolitan genus, with about 30 species worldwide. All the African species of *Elaeodendron* are treated. The present concept of *Cassine s. str.* requires many name reversals to the original basionym under *Elaeodendron.* The genus *Robsonodendron* is newly described to accommodate two southern African species. *Hartogiella* Codd and *Crocoxylon* are sunk under *Cassine* and *Elaeodendron* respectively.

This study extends the work on the southern African species of *Cassine* presented as an M.Sc. thesis in 1990. The dissertation is a compilation of 13 papers published in or submitted for publication in various scientific journals. A traditional morphologic-taxonomic approach was employed to revise the southern African Cassinoideae. Taxonomic decisions, however, were based on detailed study of palynology, leaf, wood and bark anatomy, general morphology and field observations, as well as a study of more than 4000 herbarium specimens from various herbaria. In the taxonomic treatment, each species is described, accompanied by nomenclature and notes on its distribution and ecology. Several nomenclatural problems are discussed. A proposal for the conservation of the name *Cassine barbara* L. with a new type according to new provisions of the *International Code for Botanical Nomenclature* (Greuter *et al.* 1994) is presented. All specimens examined are listed. Three colour illustrations are included. Keys to the genera and species are provided.

CHAPTER 9

OPSOMMING

’N TAKSONOMIESE HERSIENING VAN DIE SUIDER-AFRIKAANSE CASSINOIDEAE (CELASTRACEAE)

deur

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Oktober 1995

PHILOSOPHIAE DOCTOR

Die hoofdoelwit van hierdie studie was die daarstelling van ’n taksonomiese hersiening van die Suider-Afrikaanse Cassinoideae. Die Cassinoideae is een van ten minste sewe subfamilies in die morfologies uiteenlopende familie Celastraceae. Cassinoideae bestaan uit ± 21 genusse wêreldwyd waarvan agt, wat hier behandel word, in Suider-Afrika voorkom.

Daar bestaan ’n aansienlike verskeidenheid van menings oor die onderverdeling en erkenning van genusse by die spesies van *Cassine* L. *s.l.* Heelwat skrywers bepleit kleiner, meer homogene genusse, terwyl ander verkies om *Cassine* in ’n wye begrip te behandel, om sodoende delè van *Allocassine* N. Robson, *Crocoxylon* Eckl. & Zeyh., *Elaeodendron* Jacq., *Lauridia* Eckl. & Zeyh. en *Mystroxylon* Eckl. & Zeyh. in te sluit.

Nuwe getuienis uit die morfologie en anatomie, sowel as uit ander bronne, het 'n beter begrip van die generiese grense in die Suider-Afrikaanse Cassinoideae teweeggebring.

'n Klassifikasie van die Suider-Afrikaanse Cassinoideae, gebaseer op alle beskikbare getuienis, word voorgelê. In hierdie behandeling, na my oordeel die naaste moontlik aan 'n natuurlike klassifikasie, word agt genusse erken. Vyf genusse, naamlik *Cassine s. str.*, *Allocassine*, *Maurocenia* Mill., *Lauridia* en 'n nuwe genus, *Robsonodendron,* word as endemies aan Suider-Afrika beskou. Twee genusse, *Mystroxylon* en *Pleurostylia,* bestaan elk uit 'n enkele spesie in Suider-Afrika, maar het 'n onbekende aantal taksons in die Maskarene en Australasië. *Elaeodendron* is die enigste kosmopolitiese genus met ongeveer 30 spesies wêreldwyd. Al die spesies van *Elaeodendron* in Afrika word hier behandel. Die huidige konsep van *Cassine s. str.* benodig talle naamsveranderinge terug na die oorspronklike basioniem onder *Elaeodendron.* Die genus *Robsonodendron* is nuut beskryf om twee Suider-Afrikaanse spesies te huisves. *Hartogiella* Codd en *Crocoxylon* word onderskeidelik onder *Cassine* en *Elaeodendron* geplaas.

Hierdie studie brei uit op die werk oor die Suider-Afrikaanse spesies van *Cassine* voorgelê as 'n M.Sc.-verhandeling in 1990. Die proefskrif is 'n versameling van 13 artikels wat gepubliseer is of wat voorgelê is vir publikasie in verskeie wetenskaplike joernale. 'n Tradisionele morfologies-taksonomiese benadering is gebruik om die Suider-Afrikaanse Cassinoideae te hersien. Taksonomiese besluite is egter gebaseer op 'n gedetaileerde studie van palinologie, blaar-, hout- en bas-anatomie, algemene morfologie, waarnemings in die veld, sowel as 'n studie van meer as 4000 herbariumeksemplare van verskeie herbariums. In die taksonomiese behandeling word elke spesie beskryf, tesame met nomenklatuur en notas oor verspreiding en ekologie. Verskeie nomenklatoriese probleme word bespreek. 'n Voorstel vir die konservering van die naam *Cassine barbara* L. met 'n nuwe tipe volgens nuwe bepalings van die *International Code for Botanical Nomenclature* (Greuter *et al.* 1994) word gemaak. Alle eksemplare wat bestudeer is, word gelys. Drie kleurillustrasies is ingesluit. Sleutels tot die genusse en spesies word voorsien.

CHAPTER 10

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CHAPTER 11

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CHAPTER 12

CURRICULUM VITAE

Robert Hermanus Archer was born on 18 February 1965 in Johannesburg. He attended the 'Hoër Volkskool', Heidelberg and later the 'Menlopark Hoërskool', Pretoria where he matriculated in 1983. In 1984 he enrolled at the University of Pretoria, and in 1986 was awarded a B.Sc. degree with Botany, Zoology and Entomology as majors. During this undergraduate study he became interested in Celastraceae which led to the description of two new species of *Maytenus* in southern Africa. This was followed by a B.Sc. (Hons.) in Wildlife Management (1987) and an M.Sc. in plant taxonomy (1990), from the same University, the latter with distinction. F.R.D. merit bursaries were held during the period.

In 1991 he was appointed to the staff of the National Herbarium, National Botanical Institute in Pretoria. He has been engaged in mainly systematic research and has collected plant specimens from all over southern Africa. He has presented papers at congresses both locally and abroad. He is the author or co-author of more than 10 scientific and popular scientific papers.

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1. VAN WYK, A.E. & ARCHER, R.H. 1987. *Maytenus oleosa* (Celastraceae), a new species from southern Natal and Pondoland. *S. Afr. J. Bot.* 53: 155–160.
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APPENDICES[*]

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[*] The names in some publications are based on a classification of *Cassine* in a wide sense. Some names are therefore not applicable in the proposed classification.

APPENDIX 1

GENERIC DELIMITATION OF SUBFAMILY CASSINOIDEAE (CELASTRACEAE) IN AFRICA[*]

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[*] Accepted for publication in The proceedings of the XIV plenary meeting of AETFAT, 22–27 August 1994, Wageningen.

Generic delimitation of subfamily Cassinoideae (Celastraceae) in Africa

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It has long been a matter of debate whether to treat *Cassine* in a wide sense, or to recognize several segregate genera. The accumulation of new taxonomic evidence from palynology, macromorphology and anatomy, as well as other sources, leads to a better understanding of generic limits in the Celastraceae. Available evidence suggests that *Cassine s.l.* as currently circumscribed, is an extremely artificial taxon and best subdivided into smaller, more homogeneous units. Most of these groups correspond very closely with previously described segregate genera. Eight genera (*Cassine s. str.*, *Elaeodendron*, *Mystroxylon*, *Pleurostylia*, *Allocassine*, *Lauridia*, *Maurocenia* and a still to be described new genus) are proposed for the African species of Cassinoideae. *Cassine s.str.* comprises three species endemic to southern Africa.

Introduction

The genus *Cassine* was established by Linnaeus (1753, 1754), based on two southern African species, *C. peragua* and *C. maurocenia* (= *Maurocenia frangularia*). The former species was selected as the lectotype of the genus *Cassine* (Jarvis 1992). Subsequently at least ten new genera (*Maurocenia* Mill., *Elaeodendron* Jacq., *Hartogia* L.f. [a new name *Hartogiella* Codd was proposed for this illegitimate generic name (Codd 1983)], *Pleurostylia* Wight & Arn., *Crocoxylon* Eckl. & Zeyh., *Lauridia* Eckl. & Zeyh., *Mystroxylon* Eckl. & Zeyh. and *Pseudocassine* Bredell) were described for the African members of the Cassinoideae. With the exception of *Pseudocassine* [placed in Hippocrateaceae (Loesener 1942b)] and *Crocoxylon*, Loesener recognized these genera as belonging in subfamily Cassinoideae (Loesener 1942a). For the Flora Zambesiaca area, Robson (1965, 1966) described a new genus, *Allocassine*, while maintaining six genera, all considered by him to be natural taxa.

The differentiation of these segregate genera was based mainly on obvious morphological characters such as leaf disposition, floral structure and seed shape. In recent years most authors (particularly in southern Africa) applied the name *Cassine* in a broad sense, comprising all members of Celastraceae *s.str.* with indehiscent fruit except *Allocassine*, *Hartogiella*, *Maurocenia* and *Pleurostylia* (Dyer 1975; Arnold & De Wet 1993). This inclusive generic concept follows the taxonomic opinions of Loesener (1892), Davison (1927), Hou (1962), Codd (1966), Lobreau-Callen (1975), Jessup (1984) and Kostermans (1986). *Cassine s.l.* comprises about 80 species with a pantropical distribution (Mabberley 1987).

This paper emanates from a multidisciplinary approach towards a taxonomic revision of the southern African species of Cassinoideae (Archer 1990; Archer & Van Wyk 1992, 1993a, 1993b, in press). Its principal aim is to advocate the recognition of various segregate genera based on a summary of available evidence considered to be of taxonomic significance.

Results and discussions

A synopsis of taxonomically noteworthy results is presented here. Palynology (Archer & Van Wyk 1992), leaf, wood and bark anatomy (Archer 1990; Archer & Van Wyk 1993a, 1993b, in press; Hartog & Baas 1978) present a wealth of information, especially useful for generic delimitation. Several distinctive pollen, wood and bark anatomical types were recognized each separately or together showing remarkable congruence with the generic delimitation of Loesener (1942a) and Robson (1965).

Characters of fruit morphology and leaf anatomy strongly support the species groups as initially proposed on the basis of wood and bark anatomical, and palynological characters. The fact that this evidence correlates with the findings of macromorphology, is seen as strong support for the validity of the proposed segregate genera. The comprehensive generic key below largely summarizes the diagnostic characters of the genera in easily comprehensible form. It is mainly based on morphological characters, supplemented by particularly significant anatomical evidence.

Comprehensive key to the African genera of the Cassinoideae (Celastraceae)

A Leaves alternate, opposite or fasciculate, if opposite then sepals small, *c.* 1 mm long, *c.* subcircular with margin entire; ovary 2–4-locular; ovules 2 per locule; fruit drupaceous; pollen tectum reticulate to rugulose reticulate; wood with fibres septate or axial parenchyma in apotrachial bands, vessel elements simple or with perforation plates scalariform; bark relatively thick (3–15 mm; inner bark only), with abundance of large fibresclereids or brachysclereids throughout the secondary phloem, rhytidome often well developed; stomatal complexes laterocytic, latero-cyclocytic or anisocytic:

B Leaves alternate, pubescent or glabrous, elastic threads (trans-1,4 polyisoprene) often present when broken; sepals small, *c.* deltoid with margin laciniate; endocarp thin and crustaceous; wood with axial parenchyma in apotrachial bands, vessel elements simple; bark with phelloderm parenchymatous, rarely sclerified or crystalliferous; leaves with crystals absent in epidermis, stomatal complexes laterocytic or latero-cyclocytic:

C Leaves, young stems and inflorescences pubescent; elastic threads absent; sepals of equal size; ripe fruit red or tinged with red; pollen tectum reticulate with wide (1–3.5µm) lumina, sexine much thicker than nexine; bark thick (4–10 mm; inner bark only), with large brachysclereids present throughout the secondary phloem; styloid crystals absent; stomatal complexes laterocytic .. .. ***Mystroxylon***

C All parts glabrous; elastic threads present in leaf and bark (conspicuous when pieces of leaf are pulled apart); sepals unequal, outermost sepals larger than inner sepals; ripe fruit white or yellow; pollen tectum reticulate, lumina narrow (0.5–1µm), sexine and nexine of equal thickness; bark relatively thin (2–4 mm; inner bark only), sclerenchymatous elements absent in secondary phloem; styloid crystals of calcium oxalate abundant; stomatal complexes latero-cyclocytic .... ***Robsonodendron***

B Leaves usually opposite or fasciculate, glabrous; elastic threads absent; sepals small, *c.* subcircular with margin entire; endocarp thick and woody (putamen);

pollen tectum reticulate to rugulose-reticulate; wood with fibres septate in apotrachial bands, vessel elements nearly always with scalariform perforation plates; phelloderm crystalliferous and sclerified; leaf epidermal cells with prismatic crystals of calcium oxalate, stomatal complexes anisocytic . . . . ***Elaeodendron***

A Leaves usually opposite; ovary 2–3-locular; ovules 2 per locule; fruit baccate; pollen tectum reticulate or smooth; wood with septate fibres in apotrachial bands, vessel elements always simple; bark relatively thin (1–3 mm; inner bark only), sclerenchymatous elements consists of fibres or groups of isodiametric sclereids in dilated rays, or broad continuous bands of densely packed chambered crystalliferous strands, phelloderm mostly crystalliferous; stomatal complexes cyclocytic:

D Leaves coriaceous with margin revolute; sepals vestigial; ovules pendulous; pollen tectum reticulate; wood rays nearly homocellular with cells predominantly square; bark with broad continuous bands of densely packed lignified chambered crystalliferous strands; rhytidome well developed with periderm ramified; leaves with adaxial hypodermis well developed, 3–5 layers thick . . . . ***Maurocenia***

D Leaves variously textured with margin plane or occasionally revolute; sepals well-developed; ovules erect; pollen tectum reticulate or nearly smooth; wood rays heterocellular or nearly homogeneous; bark with sclereids consisting of fibres and/or groups of small isodiametric sclereids present in dilated rays adjacent to fibres, or bands of lignified chambered crystalliferous strands; leaves with adaxial hypodermis occasionally present, 1–2 layers thick:

E Shrubs or trees; inflorescence a compound dichasium; flowers pedicellate; ovary 2–3-locular; ripe fruit light to dark brown or purplish, succulent or ± fleshy; pollen tectum reticulate; wood rays heterogenous with square and procumbent cells; bark with sclereids consisting of fibres and small isodiametric sclereids in dilated rays adjacent to fibres, rhytidome weakly developed; raphide clusters of magnesium oxalate or small spheroidal calcium oxalate crystals occasionally present; leaf epidermis with straight anticlinal cell walls; adaxial hypodermis occasionally present . . . . ***Cassine***

E Lianes, scrambling shrubs, or small trees; inflorescence thyrsoid with simple or compound cymules arranged along the rachis; flowers sessile; ovary 2-locular; ripe fruit red or purple, fleshy or leathery; pollen tectum foveolate or smooth and irregularly foveolate; wood rays nearly homocellular with upright or square cells; bark sclereids consisting of fibres an/or bands of lignified chambered strands; leaf epidermis with sinuous anticlinal cell walls; hypodermis absent:

F Lianes or scrambling shrubs; leaves opposite to alternate; sepals triangular, coriaceous; flowers 5-merous; berries elliptic; wood rays consisting of predominantly upright cells; bark with fibres, periderm persistent with no sequential periderm formation, hence phellem well developed .... ***Allocassine***

F Lianes, scrambling shrubs or small trees; leaves opposite; sepals ± suborbicular, fleshy; flowers 4- or 5-merous; berries spheroid; wood ray cells consisting of predominantly square cells; bark with continuous broad bands of densely packed lignified chambered crystalliferous strands, rhytidome well developed with periderm ramified .. ***Lauridia***

A Leaves opposite; ovary with 1 fertile locule; ovules 2–4(–8?); fruit small, nutlike and lopsided with a persistent lateral style or stylar scar, pericarp thin and dry; pollen tectum smooth and irregularly foveolate; wood with axial parenchyma in apotrachial bands, vessel elements simple; bark thick (3–10 mm; innerbark only), with broad oval to irregular groups of densely packed lignified chambered crystalliferous strands, rhytidome well developed with periderm ramified; stomatal complexes cyclocytic .... ***Pleurostylia***

Table 1. African genera of the Cassinoideae; type species, estimated number of taxa and geographical distribution.

Genus	Type species	Number of spp./ subspp.	Geographical distribution
Allocassine	*A. laurifolia*	1	southern Africa
Cassine	*C. peragua*	3/3	southern Africa
Elaeodendron	*E. orientale* (Mauritius)	± 30 (9 in Africa)	southern and eastern Africa, Mauritius, India, Australasia and Neotropics
Robsonodendron	*Robsonodendron eucleiforme* (new comb. required)	2	southern Africa
Lauridia	*L. reticulata*	2	southern Africa
Maurocenia	*M. frangula*	1	Western Cape
Mystroxylon	*M. aethiopica*	1/4	Africa & Madagascar
Pleurostylia	*P. opposita* (India, Australasia and Africa)	4 (3 in Africa)	India, Australasia and Africa

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APPENDIX 2

PROPOSAL TO CONSERVE THE NAME *CASSINE BARBARA* L. WITH A CONSERVED TYPE[*]

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[*] Published in *Taxon* 44: 435 & 436 (1995).

(1170) Proposal to conserve the name *Cassine barbara* L. (*Celastraceae*) with a conserved type

Robert H. Archer[1] & Abraham E. van Wyk[2]

(1170) ***Cassine barbara*** L., Mant. Pl.: 220. Oct 1771 [*Celastr.*], *nom. cons. prop.*
Type: [South Africa, Western Cape] Rhenosterkop, *Schlechter 10574* (PRE; isotypes: BM, GRA, K, MO, P, S, Z), *typ. cons. prop.*

Studies of southern African *Celastraceae* revealed that the type of *Cassine barbara* L. belongs to the species currently known as *C. tetragona* (L. f.) Druce (in Bot. Soc. Exch. Club Brit. Isles 4: 612. 1917), based on *Rhamnus tetragona* L. f. (in Suppl. Pl.: 153. 1782). The holotype of *C. barbara* L. (Herb. Linn. No. 380.4, LINN) was clearly indicated by the name of Schreber, being cited by Linnaeus (Mant. Pl.: 220. 1771), together with a description that closely fits *C. tetragona*.

The name *Cassine barbara,* however, has been widely and persistently misapplied to another Cape taxon, not yet formally named (which is clearly a broad-leaved variant of the widespread *C. peragua* L.), e.g. by Thunberg, Fl. Cap., ed 2: 269. 1823; Sonder in Harvey & Sonder, Fl. Cap. 1: 466. 1860; Adamson in Adamson & Salter, Fl. Cape Penins.: 567. 1950; Palmer & Pitman, Trees S. Afr. 2: 1317. 1973; Coates Palgrave, Trees S. Afr.: 512 [in syn.]. 1977; Von Breitenbach, Natl. List Ind. Trees: 115, No. 411.2. 1990.

Cassine tetragona is a name correctly applied to a well known liana, shrub or small tree, usually associated with forest margins or coastal vegetation in the Western and Eastern Cape and KwaZulu-Natal, as well as in isolated localities in Swaziland and along the great escarpment of the Eastern and Northern Transvaal.

Under strict application of the principle of priority, *Cassine barbara* would, but for Art. 57 of the *Tokyo Code,* have to replace the name *C. tetragona.* Such a step would cause considerable confusion, particularly in view of the special appeal trees are enjoying among certain sectors of the public and of the fact that the epithet *"barbara"* has hitherto been applied to quite a different taxon. Because the name *C. barbara* has been widely and persistently used for a taxon not including its type, we propose its conservation with a conserved type under Art. 14.9. This would avoid a disadvantageous change in at least the specific epithet of a well known taxon, and ensures application compatible with current and past usage of the name.

An alternative course of action would be to reject the name *Cassine barbara* under Art. 56 of the *Tokyo Code.* Although such a step would keep the familiar *C. tetragona* unchallenged (to which Art. 57 already provides some protection), it still would leave the taxon generally known as *C. barbara* without an applicable name. Hence we have opted to propose conservation of *C. barbara* with a new type that matches its traditional usage. Adoption of this proposal would avoid a disadvantageous

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change in the specific epithet of a well known taxon, and would facilitate retention of that epithet in possible future infraspecific combinations (e.g., as a subspecies under *C. peragua*).

Acknowledgements

We thank Dr C. Jarvis (BM) for assisting us with the present proposal and the reviewers for their constructive comments.

APPENDIX 3

CORRECT ORTHOGRAPHY AND AUTHOR CITATION FOR *ELAEODENDRON*[*]

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[*] Accepted for publication in *Bothalia* 25, 1 (May 1996).

CELASTRACEAE

CORRECT ORTHOGRAPHY AND AUTHOR CITATION FOR *ELAEODENDRON*

Disagreement exists in the literature as to the correct form and author citation of the generic name *Elaeodendron*. Some sources refer to the taxon as *Elaeodendron*, with Jacq. f. (also abbreviated J.F. Jacq. or J. Jacq.) as validating author (e.g. Bentham & Hooker 1862; Loesener 1942; Brummitt 1992; Greuter *et al.* 1993; Green 1994), whereas others attribute the name to Jacq. or Jacq. f. ex Jacq. (Robson 1966; Villiers 1975; Proctor 1984; Robson *et al.* 1994). Kostermans (1986) argues that *Elaeodendrum* Murray (1784) has priority over *Elaeodendron* Jacq. f. (1787), and is therefore the correct name, a practice followed by, for example, Loesener (1907, 1926) and Britton & Millspaugh (1962). Jacquin f. (1787) introduced yet another variant by referring to the genus in the genitive case, namely *Elaeodendri*.

Elaeodendron was first published in 1782, without description, as a colour plate labelled *Elaeodendron orientale* and bound in the first volume of the elder Jacquin's three-volumed *Icones plantarum rariorum* (Figure 1). The colour plates of this work were issued in fascicles of 25, in an order unrelated to that in which they were eventually bound. The publication date and composition of each fascicle have been reviewed by Schubert (1945). *Elaeodendron orientale* (Plate no. 48) formed part of Fascicle 2 and was published in 1782. The text accompanying the plates of this fascicle was published a few years later, possibly in 1787 (Schubert 1945).

As source for the generic name *Elaeodendron*, the elder Jacquin (in both the text and plate bound with Vol. 1 of his *Icones*) referred to a then still unpublished manuscript of the younger Jacquin, intended for publication in *Acta Helvetica Physico-Mathematico-Botanico-Medica* Vol. 9. This series was apparently discontinued after Vol. 8 (Ingram 1966; Lawrence *et al.* 1968; Burdet *et al.* 1980), a deduction supported by the fact that no reprint of any further volumes has been found in Jacquin's library at WU, or anywhere else (Stafleu & Cowan 1979). Eventually, in 1787, the younger Jacquin's manuscript was published in the solitary issue of a new series, *Nova Acta Helvetica Physico-Mathematico-Botanico-Medica*, thus providing a description of *Elaeodendron*, albeit with the name in the genitive case as *Elaeodendri*. Although some workers (e.g. Farr *et al.* 1979; Stafleu & Cowan 1979; Howard 1989) proposed an earlier publication date (1780–1784) for this new series, evidence is overwhelmingly in favour of 1787 (Lawrence *et al.* 1968). Note, however, that some authors have erroneously attributed the contribution in *Nova Acta Helvetica Physico-Mathematico-Botanico-Medica* to the elder Jacquin, rather than to his son (e.g. Robson *et al.* 1994).

As was the case with the elder Jacquin, Murray (1784) had access to the younger Jacquin's manuscript and, although not intending to publish the genus, provided a brief description of it under the name *Elaeodendrum*. Thus Murray's description of the generic name predates those of the elder and younger Jacquin by about three years. Should Murray then not be credited as the validating author of the generic name for the taxon under discussion, as suggested by Kostermans (1986)?

According to Art. 42 of the Tokyo *Code* (Greuter *et al.* 1994), *Elaeodendron* should, despite the lack of a description, be considered validly published just on the basis of the colour plate in the *Icones plantarum rariorum*, Volume 1, t. 48 (1782). This plate meets the requirement for valid publication in containing an analysis (defined in Art. 42.4 of the *Code* as 'a figure or group of figures, ... showing details aiding identification,...') and a binomial appearing in print on it (Art. 42.3). The author citation of *Elaeodendron* is therefore correctly referred to as Jacq. (or Jacq. f. ex Jacq.). Recently, Brummitt & Powell (1992) proposed J. Jacq. as abbreviation for the younger Jacquin.

The elder Jacquin's 1787 text accompanying his 1782 plate of *E. orientale*, consists of a mere list of the parts of the illustration in Latin, but is, as in the case of the work of Murray (1784) and Jacquin f. (1787), irrelevant for the purposes of the *Code*. Arguments for accepting *Elaeodendrum* Murray as the correct generic name are therefore not valid. *Elaeodendrum* and *Elaeodendri* are to be treated merely as orthographical variants and should be corrected (Art. 61). Although the genus is often included in *Cassine* L. *s. l.*, a stricter delimitation of the genera, including the recognition of *Elaeodendron* Jacq., has recently been advocated (Archer & Van Wyk 1993a, 1993b).

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FIGURE 1.—Copy of the colour plate of *Elaeodendron orientale* Jacq. published in N.J. Jacquin's *Icones plantarum rariorum* Vol. 1 (1782). Note the name of the taxon and the reference to *Acta Helvetica* Vol. 9. The elongated leaves on the juvenile branch are typical of the species.

APPENDIX 4

ELAEODENDRON CROCEUM[*]

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[*] Published in *Flowering Plants of Africa* 54: 58–62 (1995). Colour plate 2 in frontispiece.

Flowering Plants of Africa 54: 58–62 (1995)

Elaeodendron croceum Celastraceae

South Africa, Zimbabwe

Elaeodendron croceum *(Thunb.) DC.*, Prodromus 2: 11 (1825); Pappe, Silva capensis: 10 (1854); Sond. in Harv. & Sond., Flora capensis 1: 468 (1860), *pro parte*; Marloth, Flora of South Africa 2: 154 (1925). *Ilex crocea* Thunb., Prodromus 32 (1794a); Thunb., Travels in Europe, Africa and Asia ... 1: 169; 2: 109 (1794b) [original version appeared in 1788 as Resa uti Europa, Africa, Asia ...]. *Cassine crocea* (Thunb.) Kuntze, Revisio generum plantarum 114 (1891); Von Breitenbach, The indigenous trees of southern Africa 637 (1965); Coates Palgrave, Trees of southern Africa 510 (1977). *Elaeodendron capense* Eckl. & Zeyh., Enumeratio plantarum Africae australis extratropicae 127 (1834–35); Graham in Curtis's Botanical Magazine: t. 3835 (1841); Sond. in Harv. & Sond., Flora capensis 1: 468 (1860); Marloth, Flora of South Africa 2: 154 (1925); Loes. in Die Natürlichen Pflanzenfamilien 20b: 173 (1942); Robson in Flora zambesiaca 2: 386 (1966). *Elaeodendron papillosum* Hochst. in Krauss, Flora 18: 305 (1844) [reprinted in Krauss, Beiträge zur Flora des Cap- und Natallandes 42 (1846)]. *Cassine papillosa* (Hochst.) Kuntze, Revisio generum plantarum 114 (1891); Davison in Bothalia 2: 334 (1932) *pro parte* excl. syn. *C. lacinulata* Loes.; Palmer & Pitman, Trees of South Africa 2: 1321 (1973); Coates Palgrave, Trees of southern Africa 511 (1977); Pooley, Trees of Natal, Zululand and Transkei 278 (1993).

This attractive plant is the second member of the family Celastraceae to be figured in this journal; the first one, *Catha edulis* (Vahl) Endl., appeared in Volume 43: t. 1685 (1974). The Celastraceae is a large and rather diverse family distributed worldwide in tropical and temperate zones and most of its species have been subject to considerable nomenclatural confusion and name changes. *Elaeodendron croceum* is no exception. Since the species was described by Carl Peter Thunberg (1794) as *Ilex crocea*, it has been treated by different authors under several species names within either *Elaeodendron* or *Cassine*.

Recently the tendency has been to treat *Cassine* as a large collective genus (*Cassine s.l.*) including *Elaeodendron*, a cosmopolitan genus distributed in Africa, southeastern Asia and central America, as well as the exclusively southern African species that have been included in either *Allocassine*, *Cassine s. str.*, *Crocoxylon*, *Lauridia*, *Mystroxylon* or *Pseudocassine*. *Cassine s.l.* has recently been re-examined in a multidisciplinary study of its anatomy, palynology and morphology. From the results it is clear that *Cassine* and *Elaeodendron* are well-defined natural genera and that the species under discussion belongs to *Elaeodendron*. Some distinguishing characters are to be found in the type of fruit and seed, in wood and bark anatomy, presence or absence of crystals in the

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PLATE 2112.—1, portion of flowering branch, × 1; 2, fruiting branch, × 1; 3, detail of flower, × 6. Voucher specimen: *Archer 2090* in National Herbarium, Pretoria. Artist: Gillian Condy.

epidermal layers of the leaf, and in the pollen. The results of these studies are presented elsewhere (*IAWA Journal* 14: 35–53; 373–389; *et al.*).

It is likely that Thunberg encountered our species for the first time near the Grootvadersbosch at a spot he called 'Helle or Hell' (the precise locality cannot be determined), during his first long expedition to the Gamtoos River in October 1772 (Thunberg 1794b). He did not find any flowers or fruits here to 'satisfy my curiosity'. He visited the Grootvadersbosch again on 14 January 1774. Once more he was disappointed and found few trees in flower or fruit. However, he collected sterile specimens of the species, in the knowledge that he would not visit the place again. He described the species as follows: 'Yellow wood (Geelhout, *Ilex crocea*) is of a yellow colour, almost like box, of a close texture, and handsome. It is used for planks and beams in the construction of houses, for tables, doors, cupboards, window-frames, and butter-churns.' This forest was an important source of timber for Cape Town at the time.

Although the name *Ilex crocea* appeared in print in the first edition of Thunberg's *Resa uti Europa, Africa, Asia* ... (1788) and in the English translation (Thunberg 1794), neither of these two accounts is considered a validly published diagnosis of the species, since Thunberg intended to publish the name of his species elsewhere, '... for fear of tiring out the patience of the generality of my readers ...'.

Most authors have mistaken the identity of Thunberg's *Ilex crocea*. The type specimen of this name was carefully studied by the present author and there can be no doubt that it belongs to the species depicted here. Until recently, the name *Crocoxylon croceum* (Robson 1966) or *Cassine crocea* (Arnold & De Wet 1993, *Plants of southern Africa: names and distribution*) has been applied to an undescribed species. It is comparatively rare but is found east of Port Elizabeth in the Eastern Cape Province, in KwaZulu-Natal, and in very isolated localities in Northern Transvaal and Mozambique. Its leaf margins are glandular-denticulate, never spinulose-denticulate, a condition often very marked in juvenile leaves of *Elaeodendron croceum*.

Our species was illustrated in *Curtis's Botanical Magazine* in 1841 as *Elaeodendron capensis* Eckl. & Zeyh., a name also used by Robson, in *Flora zambesiaca*. Ecklon & Zeyher were obviously not aware of the true identity of Thunberg's *Ilex croceum*. In their *Enumeratio plantarum* they not only published the taxonomic synonym *Elaeodendron capensis*, but also chose the superfluous name *Crocoxylon excelsum* as the new name for *E. croceum*, apparently applying the so-called Kew Rule that was already implemented at the time. The generic description of *Crocoxylon* and the two specimens cited in the *Enumeratio* *plantarum*, however, clearly refer to the up to now undescribed species (*Cassine crocea auct.*). This confusion has been perpetuated by most subsequent authors.

Under *Cassine*, where the species has usually been placed, the epithet *capensis* could not be used due to the existence of Linnaeus's *C. capensis* (= *C. peragua* L.). The next available epithet, which has been in use up to now, is *papillosa*.

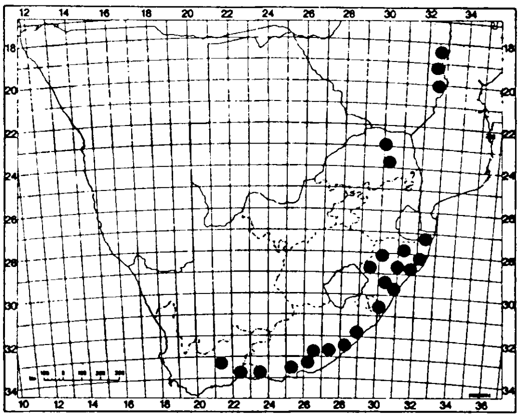

FIGURE 1.—Known geographical distribution of *Elaeodendron croceum*.

This species usually occurs on the margins of coastal and other forests, from near Ladysmith in the west to northern KwaZulu-Natal, as well as in isolated spots on the escarpment of the Eastern Transvaal and Mount Chirinda in Zimbabwe. It is, however, most abundant in the southern Cape forests (Figure 1). It is also recorded from St Helena, but this could be attributed to the establishment of plantations of this tree by early colonists. Melliss (1875, *St. Helena*), considered this species (which he placed under *Olea* ? sp. and called wild olive) as very common and 'one of the handsomest trees on the island'.

There is evidence that *Elaeodendron croceum* is distributed by fruit bats in the southern Cape. Fruits of this species with the flesh removed are often collected in pit traps in forests, with fine tooth marks on the putamen. Phillips (1927, in *South African Journal of Science* 24: 436–437) gives an account of the part played in fruit dispersal by the bushdove [Rameron pigeon (*Columba arquatrix*)]. The fruit may be dispersed for long distances. Even elephants (*Loxodonta africana*) have been reported as dispersal agents (Phillips 1925, in *South African Journal of Science* 22: 290).

The vernacular names saffron, common saffron or saffronwood and also *geelhout* or yellow wood were recorded by Thunberg for the species and used in the specific epithet: *croceum* means 'saffron yellow' and is derived from the colour of the stamens of *Crocus sativus* (Stearn 1983, *Botanical Latin*). This colour originates from a yellow pigment in the bark of most species of the family Celastraceae. Ecklon & Zeyher (1834–35) gave a literal translation of saffronwood when they proposed the generic name *Crocoxylon*. In Coates Palgrave (1977) and Von Breitenbach (1987, *National list of indigenous trees*), common names of the other related species are usually listed with qualitative prefixes, e.g. Cape saffron or red saffron.

Like Thunberg, Pappe (1854) recorded the use of *Elaeodendron croceum* for the manufacture of all kinds of furniture and general wagon work, as well as butter casks.

Preparations of the root and bark have proved to be fatal to humans, presumably due to the presence of alkaloids. The exact nature of these alkaloids is not yet known. The bark was used in dyeing and tanning by Voortrekker settlers (Watt & Breyer-Brandwijk 1962, edn 2, *The medicinal and poisonous plants of southern and eastern Africa*).

Personal experiments have shown that this species can be grown readily from seed and from cuttings, but it is usually not a fast grower. If the putamen covering the seed is not removed or damaged, germination can take anything from 12 to 30 months. The material on which this colour plate is based, was taken from a plant growing in the Pretoria National Botanical Garden. The plants were collected as cuttings and seeds from near Knysna and George.

Description.—Medium to tall evergreen tree, unarmed, glabrous. *Bark* greyish with layers of a powdery yellow pigment in exposed rhytidome exfoliating in thin scales, surface longitudinally fissured. *Branchlets* subangular to terete, greyish brown, lenticels prominent, black. *Leaves* opposite; lamina elliptic to oblong, dark green above, lighter below, 15–220 × 10–70, base attenuate, apex acute to acuminate, margin glandular-denticulate to prominently spinulose-denticulate on juvenile shoots, coriaceous, venation not conspicuous; petiole 4–10 mm long; stipules minute, triangular. *Inflorescences* usually pedunculate, compact dichasial, axillary towards apices of branchlets, 3–15-flowered; peduncles 3–12 mm long; bracts minute and bracteoles occasionally present. *Flowers* 4-merous, ± 3 mm in diameter; pedicels 1–2 mm long. *Sepals* greenish, ovate, 1.5 × 1 mm, fleshy. *Petals* whitish green, widely ovate, 1.5 × 1.5 mm, spreading. *Stamens* erect to spreading; filaments 0.5 mm long, introrse. *Disc* subentire with sinuses at point of stamen insertion, flat to concave. *Ovary* 2-locular; style and stigma inconspicuous. *Fruit* drupaceous, ellipsoid, cream, 20–30 × 10–15 mm, putamen narrowly elliptic, tapered at both ends. *Seeds* light brown, narrowly ellipsoid, 15–20 × 4–5 mm; embryo with fleshy cotyledons. Plate 2112.

R.H. ARCHER* (text) and GILLIAN CONDY* (colour plate)

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APPENDIX 5

CASSINE PERAGUA[*]

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[*] Accepted for publication in *Flowering Plants of Africa* 55 (1996). Colour plate 1 in frontispiece.

Cassine peragua

Celastraceae

Southern Africa

Cassine peragua L. Species Plantarum 1: 268 (1753); Robson in Boletim da Sociedade Broteriana 39: 36, 37 (1965); Palmer & Pitman, Trees of South Africa 2: 1317 (1973); Coates Palgrave, Trees of southern Africa: 512 (1977); Pooley, Trees of Natal, Zululand and Transkei: 278 (1993); Archer & Van Wyk in prep. *Cassine capensis* L. Mantissa: 220 (1771); Thunb., Prodromus: 52 (1794); Flora Capensis: 269 (1823); Eckl. & Zeyh., Enumeratio Plantarum Africae Australis Extratropicae: 128 (1834–35); Sond. in Harv. & Sond., Flora Capensis 1: 466 (1860). *Euonymus colpoon* L. Mantissa: 200 (17). *Cassine colpoon* (L.) Thunb., Prodromus: 52 (1794); Flora Capensis: 227 (1818). *Cassine kraussiana* Bernh. in Krauss, Flora 18: 305 (1844); Davison in Bothalia 2: 333 (1927); Von Breytenbach, The indigenous trees of southern Africa: 637 (1965); *Elaeodendron kraussianum* (Bernh.) Sim.,The forest and forest flora: 190 (1906).

Cassine peragua is only the third member of a large and diverse family, the Celastraceae, to be illustrated in Flowering Plants of Africa, undoubtedly because the flowers of the family are small and inconspicuous. However, most species of this family are evergreen and often bear colourful fruit, making them suitable garden plants.

The typification and the circumscription of the genus *Cassine* have received considerable attention. Linnaeus (1754) in Species Plantarum: 268 & 269 described two species under *Cassine*, namely *C. maurocenia* and *C. peragua*. These taxa were based on two monotypic genera by Dillenius and by Linnaeus himself. Miller in Gardener's dictionary abridg. edn 4. (1754), rectified what he thought was a mistake on the part of Linnaeus in lumping the two genera together, and validly described *Maurocenia*, the monotypic genus originally published by Linnaeus in his Hortus Cliffortianus: 108 (1737) and Genera Plantarum edn 2: 102 & 103 (1743).

Hitchcock (1929) chose *Cassine maurocenia* L., which also provides the type of *Maurocenia* Mill., as the type of *Cassine* L. So typified, *Cassine* would be the correct name for the genus known as *Maurocenia* and a new name would be necessary for what is called *Cassine*. Jarvis in Taxon 41: 559 (1992) made a proposal to conserve the type of

Cassine, in order to maintain the current use of *Cassine*, and the name is therefore to be used as a *nomen conservanda proposita*.

Incidentally, the specific epithet of our taxon is inappropriate. When Linnaeus described this species, he confused his plant with one from the Bahamas (Linnaeus' Carolina: Stearn 1957, Introduction to A Facsimile of the first edition of Species Plantarum), which apparently looks identical to a Paraguayan plant, therefore the epithet *peragua*. Later he noticed his mistake and, in the Mantissa: 220 (1771), he renamed his plant *Cassine capensis*. However, under the International Rules of Botanical Nomenclature, this procedure is not acceptable, since the oldest validly name for the taxon is the one that must be adhered to.

Cassine is often treated in a very broad sense to include *Elaeodendron* and the mainly southern African genera, *Crocoxylon*, *Mystroxylon* and *Lauridia*. Up to 80 species have been described in *Cassine s.l.* worldwide. A recent multidisciplinary research project covering different aspects of anatomy, morphology and palynology has shown that *Cassine*, as currently circumscribed, is an extremely artificial taxon and is best subdivided into smaller, distinct and more homogeneous units that correspond closely with previously described genera. The results of these studies are being presented elsewhere, e.g. in *IAWA Journal* 14: 35–53; 373–389. Thus it becomes clear why it is so important to determine the type species of *Cassine*.

Among the important differences between *Cassine* and the segregate genera now ascertained, is the presence of berries in *Cassine*, whereas *Elaeodendron* has drupes, with a thick layer of endocarp or putamen that is extremely difficult to break open. The fruit of other genera differs by having a thin and crustaceous endocarp or lacking a differentiating endocarp. Other noteworthy features are different wood and bark types, type and presence of crystals in the leaf epidermis, stomatal type and pollen type. Such a degree of taxonomically significant morphological variation found in a single genus (*Cassine s.l.*) is unusual and calls for generic segregation.

Cassine as here circumscribed, comprises four taxa endemic to southern Africa. All four taxa are most frequent in the Western Cape, with only *C. peragua* having a distribution extending into Natal, Swaziland and few isolated localities in the Eastern and Northern Transvaal. This species can be considered extremely rare in these provinces. One branch (1) figured here was collected by Mr Norbert Hahn in the Soutpansberg, Northern

Transvaal after a long search initiated by the present author. Other collections have been made in the Ceylon Forest, Mount Sheba, Ohrigstad Dam Nature Reserve and near Barberton with no more than a few plants present at each locality. The other branch on the plate (2) originates from the Kirstenbosch National Botanic Garden in Cape Town.

Three definite forms of our species are formally recognized as subspecies (Archer & Van Wyk in prep). *Cassine peragua* subsp. *barbara* is a coastal, low, often stunted shrub with the lamina mostly circular (☐ on distribution map). The typical subspecies, which is illustrated here, is a large shrub or tree, and is the most widespread (▲). The third subspecies *affinis* (●)is a slender tree in the Clanwilliam district in the Western Cape and often confused with *Hartogiella schinoides* (Spreng.) Codd. *Hartogiella* is, however, closely related to *Cassine* and can be better accommodated in *Cassine*.

A common name for this species is Cape Saffron, after the yellow pigment in the bark. This pigment is present in most taxa in the Celastraceae and can often be used to distinguish the family.

The leaves of our species are reported to be toxic, and have caused death in animals in trials (Watt & Breyer-Brandwijk 1962, edn 2, The medicinal and poisonous plants of southern and eastern Africa). Pappe, Silva Capensis: 11 (1854), described the wood as hard tough, but very handsome when varnished and used by cabinet makers and wheelwrights.

Our species is seldom found in gardens, and little is known about its cultivation. From personal experience it grows from seed and from cuttings, but it is a slow grower. Trees in Kirstenbosch National Botanical Gardens bears a attractive colourful display of fruit.

Description. —Slender to tall evergreen tree up to 10 m high, bark greyish with layers of a yellow pigment in the exposed rhytidome, visible when scratched lightly. *Branchlets* weakly four-lined when young, greyish brown. *Leaves* opposite, lamina elliptic to broadly elliptic, 20–75 x 10–40 mm, base attenuate, rarely rounded, apex rounded to retuse, margin glandular crenate, crenations usually 6–14 on each side, subcoriaceous, pale-green; venation conspicuous; petioles 2–4 mm long; stipules minute, dark brown. *Inflorescences* regularly dichasial. *Flowers* 4- or 5-merous, ± 5 mm diam. *Sepals* greenish, 1.5 x 1 mm, margin ciliolate. *Petals* cream, 2.5 x 1.5 mm, margin entire. *Stamens* erect, ± 2 mm, arising from sinuses in the disc. *Disc* subentire, with prominent sinuses, flat. *Ovary* partially immersed in an sub-entire disc, 2- or -3-locular, with 2 erect ovules per locule. *Style* short; stigma 2-lobed. *Fruit* a berry, brown to purplish brown, ± 10 mm diam. *Seeds* usually 1 or 2, but up to 6 per fruit, spheroid when developing alone, brown; fleshy endosperm present. Plate 1 (Frontispiece).

Robert H. Archer[*] (text) and Gillian Condy[*] (colour plate)

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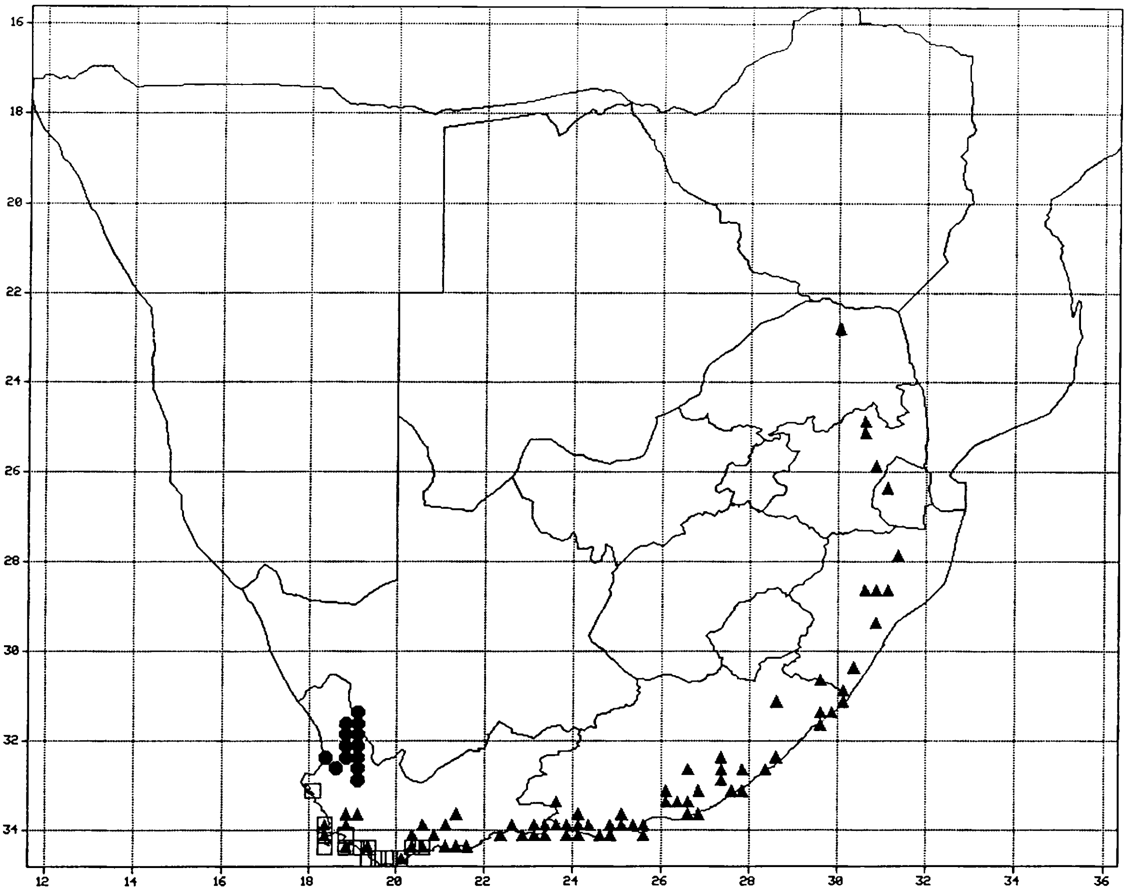

FIGURE 1.—Known geographical distribution of *Cassine peragua* (▲) and two subspecies, *barbara* (❑) and *affinis* (●).

APPENDIX 6

PALYNOLOGY AND GENERIC STATUS OF SOME SOUTHERN AFRICAN CASSINOIDEAE (CELASTRACEAE)[*]

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[*] Published in *Grana* 31: 241–252 (1992).

Grana 31: 241–252, 1992

Palynology and intergeneric relationships in some southern African species of subfamily Cassinoideae (Celastraceae)

R. H. ARCHER and A. E. VAN WYK

Archer, R. H. & Van Wyk, A. E. 1992. Palynology and intergeneric relationships in some southern African species of subfamily Cassinoideae (Celastraceae). – Grana 31: 241–252. ISSN 0017-3134.

It has long been a matter of controversy whether to treat *Cassine* L. in southern Africa in a wide sense, or to recognize several segregate genera, such as *Elaeodendron* Jacq. f., *Crocoxylon* Eckl. & Zeyh., *Lauridia* Eckl. & Zeyh., *Mystroxylon* Eckl. & Zeyh. and *Cassine* s. str. The pollen morphology of the 14 southern African species currently included in *Cassine* s.l., as well as the three monotypic genera *Allocassine* N. Robson, *Hartogiella* Codd, and *Maurocenia* Mill., has been studied by means of LM, SEM and TEM. Pollen grains in all species shed as monads, radially symmetrical, isopolar, tricolporate with colpus membranes conduplicate, tectate, subspheroidal, 14–30 µm in equatorial and 13–37 µm in polar diameter. On the basis of sexine sculpture three pollen types are recognized. Pollen type A (sexine reticulate) has been recorded in *Maurocenia, Hartogiella, Cassine aethiopica, C. barbara, C. burkeana, C. eucleiformis, C. maritima, C. papillosa, C. parvifolia,* and *C. peragua*; pollen type B (sexine foveolate/psilate) occurs in *Allocassine, C. reticulata* and *C. tetragona,* whereas pollen type C (sexine rugulose-reticulate) is characteristic of *C. crocea, C. matabelicum, C. transvaalensis* and *C. schlechteriana*. Palynologically it is clear that *Cassine* s.l., as currently circumscribed, is an artificial taxon, perhaps best subdivided into smaller, more homogeneous units.

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(Manuscript received 5 December 1990; revised version accepted 5 December 1991)

The genus *Cassine* was established by Linnaeus (1737, 1753) and based on two southern African species, *C. peragua* and *C. maurocenia* (= *Maurocenia frangularia*). The former species has subsequently been selected as the lectotype of the genus (Robson 1965). In the second edition of Engler & Prantl's *Die natürlichen Pflanzenfamilien*, Loesener (1942*a*) recognized six genera among those southern African Celastraceae with fleshy fruits, namely *Cassine, Elaeodendron* Jacq. f., *Lauridia* Eckl. & Zeyh., *Maurocenia* Mill. and *Mystroxylon* Eckl. & Zeyh. In addition, *Pseudocassine* Bredell (based on *C. transvaalensis*) has been treated separately in the Hippocrateaceae (Loesener 1942*b*). Robson (1965, 1966) and Robson & Sousa (1969) also subdivided these fleshy-fruited members into what they considered to be five more natural genera, namely *Allocassine* N. Robson, *Cassine* s.s., *Elaeodendron, Crocoxylon* Eckl. & Zeyh. and *Mystroxylon*. The differentiation of these segregate genera was based mainly on more obvious morphological characters such as leaf disposition, floral structure and seed shape.

In recent years the National Herbarium (PRE) in Pretoria has applied the name *Cassine* in a broad sense, comprising all the southern African members of the Celastraceae with indehiscent fruits except *Allocassine, Hartogiella, Pleurostylia* Wight & Arn. and *Maurocenia* (Gibbs Russell et al. 1987). *Pleurostylia*, however, is clearly distinct and can easily be identified by its unilocular ovary and the remains of the style on one side near the base of the fruit. This inclusive generic concept follows the taxonomic opinion of authors such as Loesener (1892), Davison (1927), Hou (1962), Codd (1966) and Kostermans (1986), and is currently well established in the taxonomic literature. *Cassine* in a broad sense comprises about 80 species with a pantropical distribution (Mabberley 1987).

The Celastraceae were considered stenopalynous by Erdtman (1966). Subsequently, extensive palynological studies on the Celastrales, including observations on many members of the Celastraceae were conducted by Lobreau (1969), Lobreau-Callen (1974, 1975*a*, 1975*b*, 1976, 1977) and Lobreau-Callen & Lugardon (1973). Pollen grains of the Celastraceae (excluding Hippocrateaceae) were also studied by among others Hou (1969), Rao & Leong (1974), Sebsebe (1985), Rasoarimalala et al. (1982), Lieux (1983) and Goldblatt et al. (1985).

Palynological data on *Cassine* are scanty and include the contributions by Rao & Leong (1974 – one species), Guinet (1962 – one species), Rasoarimalala et al. (1982 – two species), Lobreau (1969) and Lobreau-Callen (1974, 1975*a*, 1977 – 25 species). Pollen of five southern African species of *Cassine*, namely *C. aethiopica, C. crocea, C. eucleifor-*

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Table I. *Pollen morphological data for southern African Cassinoideae, compared with a proposed alternative generic treatment based on a wide range of information from diverse sources.*

Scientific names of species follow current herbarium practice at PRE (Gibbs Russell et al. 1987) and most other southern African herbaria

Species investigated	Polar diam. (µm) $\bar{X}$ (Range)	Equatorial diam. (µm) $\bar{X}$ (Range)	100 P/E $\bar{X}$ (Range)	Generic treatment after Archer (1990)
Pollen type A				
Cassine aethiopica	23.5 (20.5–28)	21.6 (19–26)	109 (100–120)	*Mystroxylon*
C. burkeana	20 (18–22)	18.7 (18–20)	107	
C. eucleiformis	21.9 (17–26)	20.3 (18–24.5)	103 (95–109)	Genus nov.
C. maritima	23.5 (20.5–26)	21.3 (19–24)	110 (108–112)	(to be described)
C. papillosa	27 (25–30)	24.7 (22–28)	109 (107–111)	*Elaeodendron*
C. barbara	25.9 (23.5–34)	24.9 (20–30)	104 (103–106)	*Cassine* s. str.
C. parvifolia	25.5 (23–29)	23 (22–28)	110 (100–124)	
C. peragua	27.7 (22–33)	26 (21.5–29)	107 (103–112)	
Hartogiella schinoides	26 (23–28)	26 (22–30)	100 (96–104)	
Maurocenia frangularia	15.5 (14–17)	15 (13–16)	103	*Maurocenia*
Pollen type B				
Allocassine laurifolia	21.8 (19–26)	21.7 (19.5–27)	101	*Allocassine*
Cassine reticulata	20.9 (18.5–24)	19.3 (18.6–20.5)	108 (104–111)	*Lauridia*
C. tetragona	16.6 (13–21.5)	16.8 (15–20.5)	99 (85–118)	
Pollen type C				
Cassine crocea	27.2 (24–30)	22.9 (20–25)	118 (113–123)	*Crocoxylon*
C. matabelicum	27.1 (24–32)	24.3 (22–29)	111 (108–119)	
C. schlechteriana	35.1 (33–37.5)	27.3 (27–28.5)	129	
C. transvaalensis	27.8 (26–30.5)	25.5 (22–29.5)	109 (105–114)	

mis, *C. maritima* and *C. peragua*, as well as *Maurocenia* and *Hartogiella*, was included among those studied by Lobreau-Callen (1974, 1975*a*, 1977). Although the latter found some pollen morphological variation in the group, it was considered insufficient to support the generic subdivision proposed by Loesener (1942*a*) and Robson (1965, 1966). Lobreau-Callen (1975*a*) nevertheless recognized two pollen types in *Cassine*. The first consists of grains with inconspicuously replicate apertures and a relatively coarse muri structure, as in *C. peragua*. The second pollen type is characterized by conspicuously replicate apertures (due to a decrease in sexine thickness), and a fine muri structure, as in *C. orientalis* Kuntze. The occurrence of these two types correspond to some extent with the segregate genera proposed by Robson (1965) and Archer (1990).

Existing knowledge on the pollen morphology of *Cassine* has been gained predominantly through light microscopical (LM) studies. The value of LM for the detection of variation in pollen wall stratification and surface sculpture is limited. The combined use of the scanning (SEM) and transmission (TEM) electron microscope has, however, greatly facilitated the study of the detailed structure of the pollen grain. For a better understanding of the generic limits of *Cassine*, detailed evidence from many sources, including pollen morphology, are required. This paper emanates from a multidisciplinary approach towards a taxonomic revision of the southern African species of fleshy-fruited Celastraceae (Archer 1990). Its principal aim is to evaluate critically the taxonomic status of the various segregate genera on the basis of palynological evidence.

MATERIAL AND METHODS

Pollen of the 14 currently recognized species of *Cassine* s.l. in southern Africa (Gibbs Russell et al. 1987), as well as the monotypic genera *Allocassine*, *Hartogiella* and *Maurocenia* was studied by LM and electron microscopy. Anthers with pollen grains were removed from open flowers of herbarium specimens housed in the H. G. W. J. Schweickerdt (PRU) and National Herbarium (PRE). Species names and voucher specimens are supplied under "Specimens investigated".

Polliniferous samples were acetolyzed (Erdtman 1960) and thoroughly washed, first with distilled water, and then ethanol. For LM, pollen was mounted in glycerine jelly and permanently sealed with entellan by the method of Fripp (1983). For SEM the pollen-ethanol mixture was air-dried on glass coverslips attached with silver paint to SEM stubs (the glass ensures a clean dark background on micrographs), sputter-coated with gold and viewed with a JEOL 840 SEM.

Both TEM and SEM were used for the study of the wall structure of pollen grains of selected species. Rehydrated pollen was fixed in formalin-acetic acid-alcohol (FAA) (Johansen 1940), then in 2,5% glutaraldehyde, washed in Na-cacodylate buffer at pH 7.4, postfixed for one hour in 1% OsO_4 in distilled water, washed in three changes of 0,07 M $NaPO_4$ and dehydrated in acetone. Quitol 651 resin (Kushida 1974), as modified by Van der Merwe & Coetzee (1986), was used for embedding. Ultrathin sections were contrasted with lead citrate (Reynolds 1963), and examined in a Philips EM312 TEM. In addition, sections ca. 1 µm thick, of resin-embedded pollen were mounted on glass coverslips, deplasti-

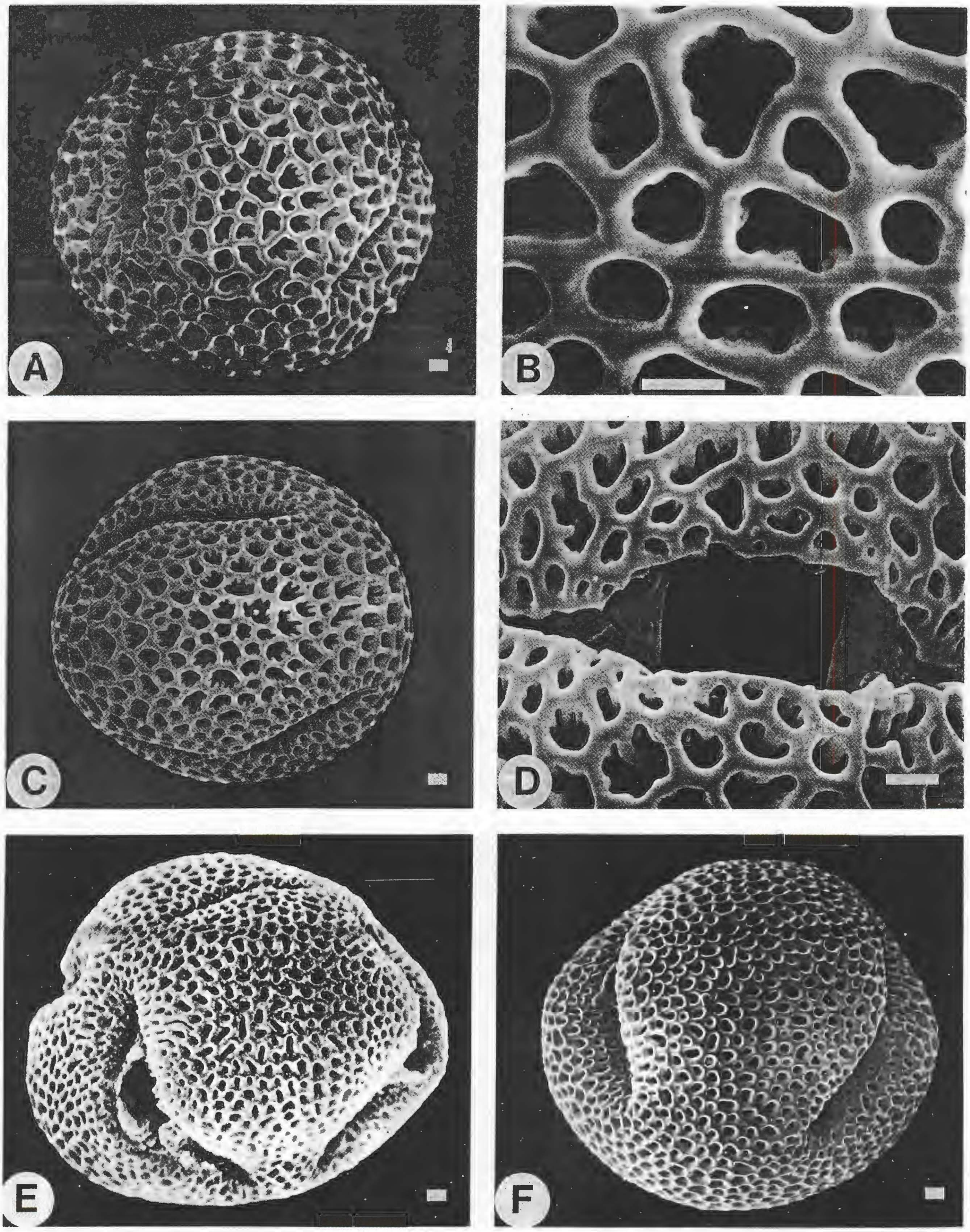

Fig. 1. A-F. SEM micrographs of pollen grains of *Cassine* s.l. (Type A). A-D. *C. aethiopica*. (A) Equatorial view (Reekmans 10548). (B) Portion of mesocolpium showing detail of exine (Reekmans 10548). (C) Equatorial view (Thode 2623). (D) Equatorial view showing aperture (Klopper 60A). (E) *C. eucleiformis*, equatorial view (Gerstner 3238). (F) *C. maritima*, equatorial view (Fourcade 3273). Scale lines = 1 μm.

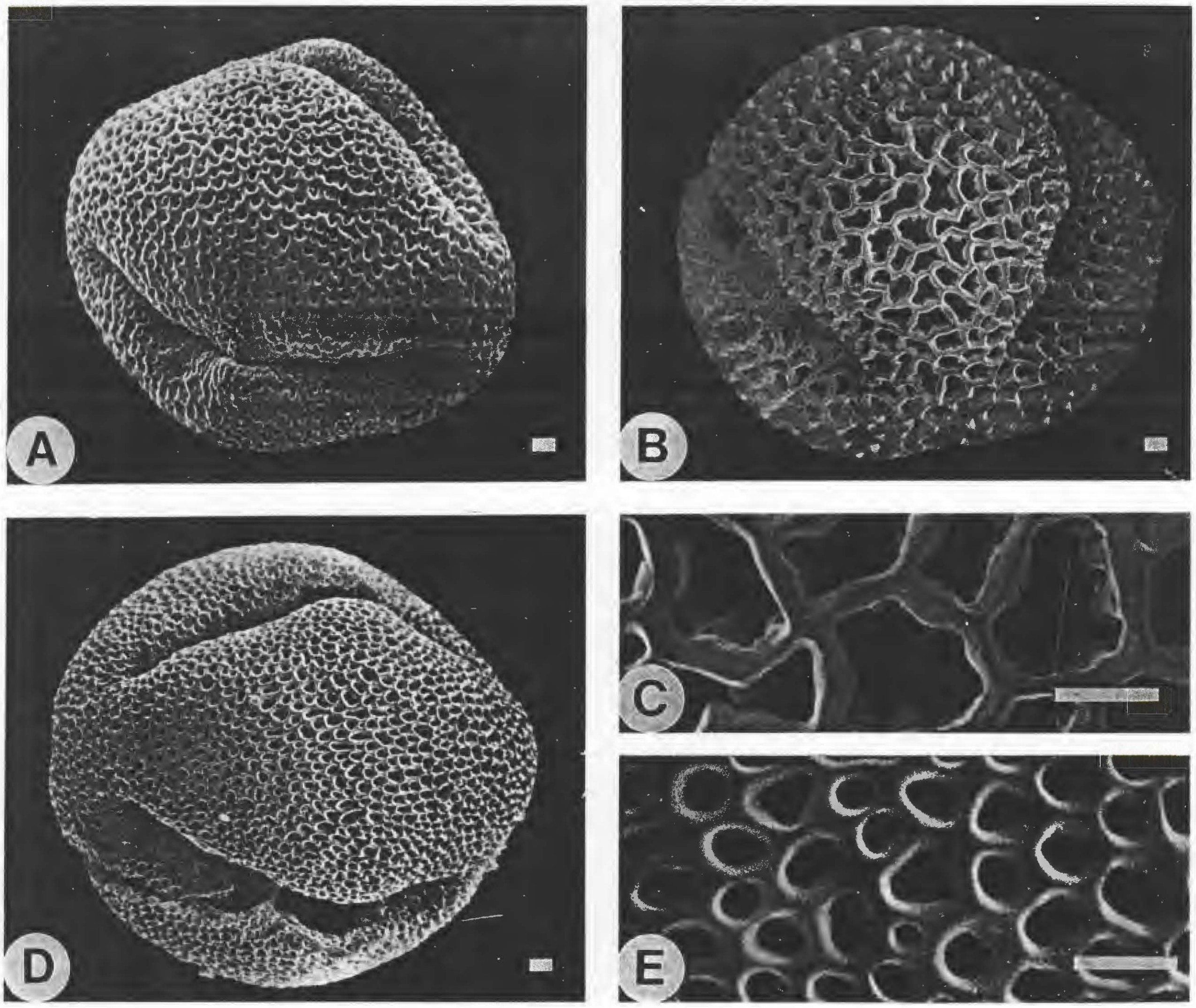

Fig. 2. A-E. SEM micrographs of pollen grains of *Cassine* s.l. (Type A). (A) *C. barbara*, equatorial view (Leighton 1056). B, C. *C. parvifolia* (Oliver 3947). (B) Equatorial view. (C) Portion of mesocolpium, note sharp edge of the muri. D, E. *C. peragua* (Taylor 8461). (D) Equatorial view. (E) Detail of equatorial view. Scale lines = 1 µm.

cized by treatment with a saturated solution of NaOH in ethanol (Skvarla et al. 1988), and viewed under SEM.

Measurements of pollen grains were made with a projecting LM and are based on at least 10 grains per sample. The descriptive terminology used follows mainly Erdtman (1966) and the attempts at standardization offered by Reitsma (1970) and Nilsson & Muller (1978), as well as Lobreau-Callen (1975*b*).

DESCRIPTION OF POLLEN TYPES

General pollen morphological description

Pollen grains in all species shed as monads, radially symmetrical, isopolar, subspheroidal, equatorial diameter 14–30 µm, polar 13–37 µm, tricolporate. Amb circular to angular. Colpi granular, 10–25 µm long, tapering meridionally; endexine fold (conduplication) conspicuous or hardly noticeable. Pori as wide or wider than colpi. Exine with sexine 2–3 µm thick, columellate, tectate, nexine 0.4–1.5 µm thick. Sexine ornamentation psilate, foveolate, reticulate to rugulose-reticulate; muri isodiametric to irregular, finer towards colpi.

On the basis of mainly exine structure and surface patterning, three distinct pollen types are recognized. The description of each pollen type is followed by more specific notes on its representation among the investigated taxa. Variation in the sizes of pollen grains are summarized in Table I.

Type A (reticulate grains)

Pollen grains 18–30 µm in equatorial, 17–30 (37) µm in polar diameter. Amb circular to subcircular. Tectum reticulate, abruptly merging with colpus membrane; muri 0.3–0.6 µm thick with outer edges rounded or sharply tapered, surface smooth or with perforations; lumina irregular in

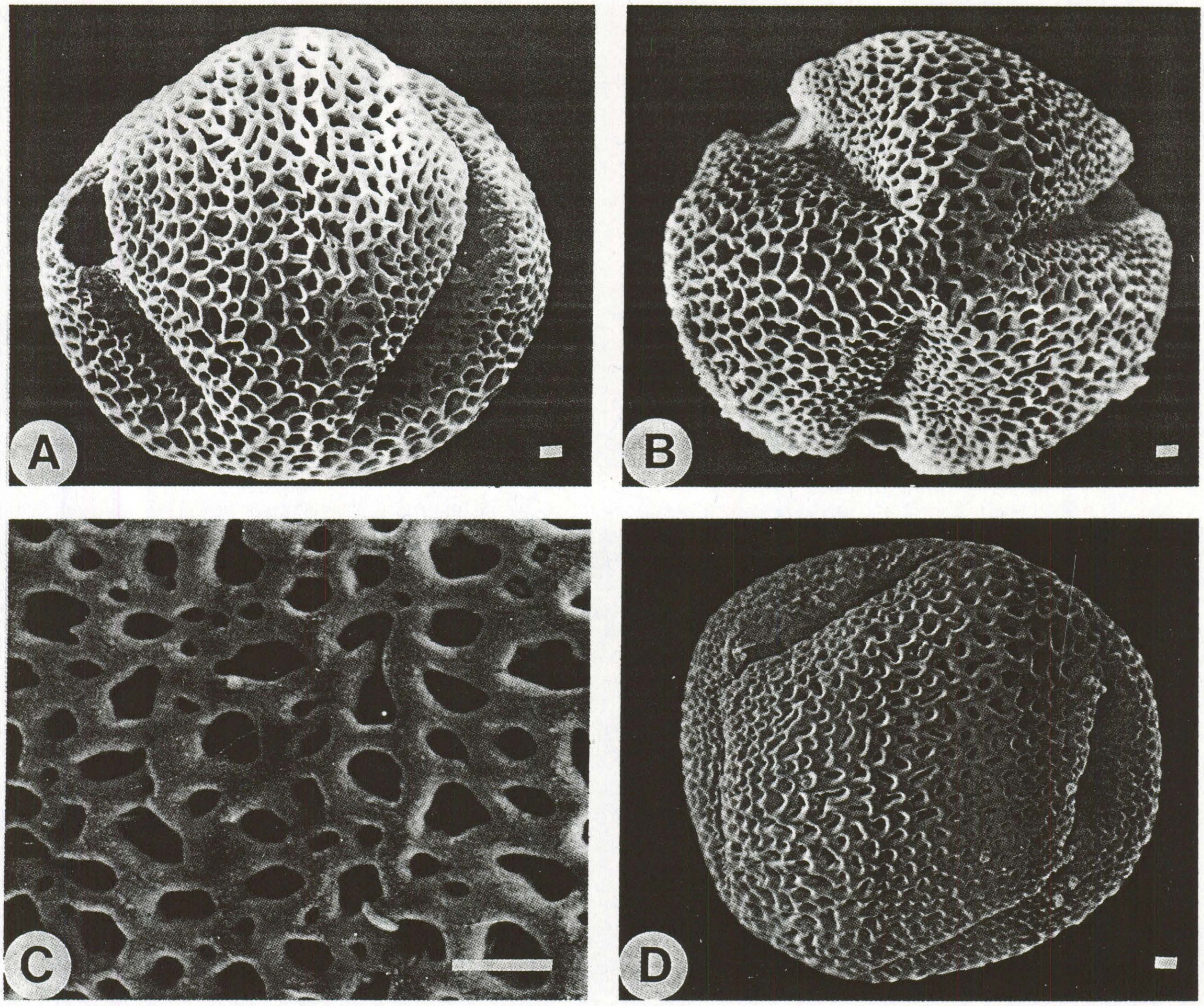

Fig. 3. A-D. SEM micrographs of pollen grains of *Cassine* s.l. and ***Maurocenia*** (Type A). A-C. *C. papillosa*. (A) Equatorial view (Deall 2279). (B) Polar view (Deall 2279). (C) Portion of mesocolpium, showing detail of exine (Scheepers 675). (D). *M. frangularia*, equatorial view (Marloth 5978). Scale lines = 1 μm.

diameter. Exine 2–3 μm thick; sexine thicker than nexine. Columellae relatively long (ca. 1 μm) and flattened. Colpi with endexine fold.

Species included: *Cassine aethiopica* (Figs. 1A-D, 4A-C), *C. barbara* (Figs. 2A, 4D), *C. burkeana* (Fig. 4E), *C. eucleiformis* (Figs. 1E, 4F), *C. maritima* (Fig. 1F), *C. papillosa* (Figs. 3A-C, 4G-J), *C. parvifolia* (Figs. 2B, C; 4K, L), *C. peragua* (Fig. 2D, E), *Hartogiella schinoides* and *Maurocenia frangularia* (Fig. 3D).

Few constant interspecific differences were found. The outer edges of the muri are rounded in most species, but sharply tapered in *C. parvifolia* (Fig. 2B, C) and occasionally in *H. schinoides*. Perforations were found in the muri of *C. papillosa*. Pollen grains of *C. aethiopica* are usually characterized by exceptionally wide (1–3.5 μm) lumina (Fig. 1A–C). The exine is relatively thin in *C. eucleiformis* and *C. maritima*.

Type B (foveolate/psilate grains)

Pollen grains 14–27 μm in equatorial, 13–26 μm in polar diameter. Amb semi-triangular to circular. Tectum either

Fig. 4. A-L. Light micrographs of *Cassine* s.l. (Type A). A-C. *C. aethiopica*. (A) Equatorial view showing surface structure (Von Teichman 344). (B) Equatorial view, optical cross section (Klopper 60A). (C) Polar view, optical cross section (Von Teichman 344). (D) *C. barbara*, polar view, optical cross section (Leighton 1056). (E) *C. burkeana*, polar view, optical cross section (Van Rooyen 2228). (F) *C. eucliformis*, polar view, optical cross section (Wood 9403). G-J. *C. papillosa* (Scheepers 675). (G) Equatorial view showing surface structure. (H) Equatorial view, optical cross section. (I) Equatorial view, showing aperture. (J) Polar view, optical cross section. K, L. *C. parvifolia* (Oliver 3947). (K) Equatorial view showing surface structure. (L) Polar view, optical cross section. Endexine folds arrowed. All magnifications at X1000.

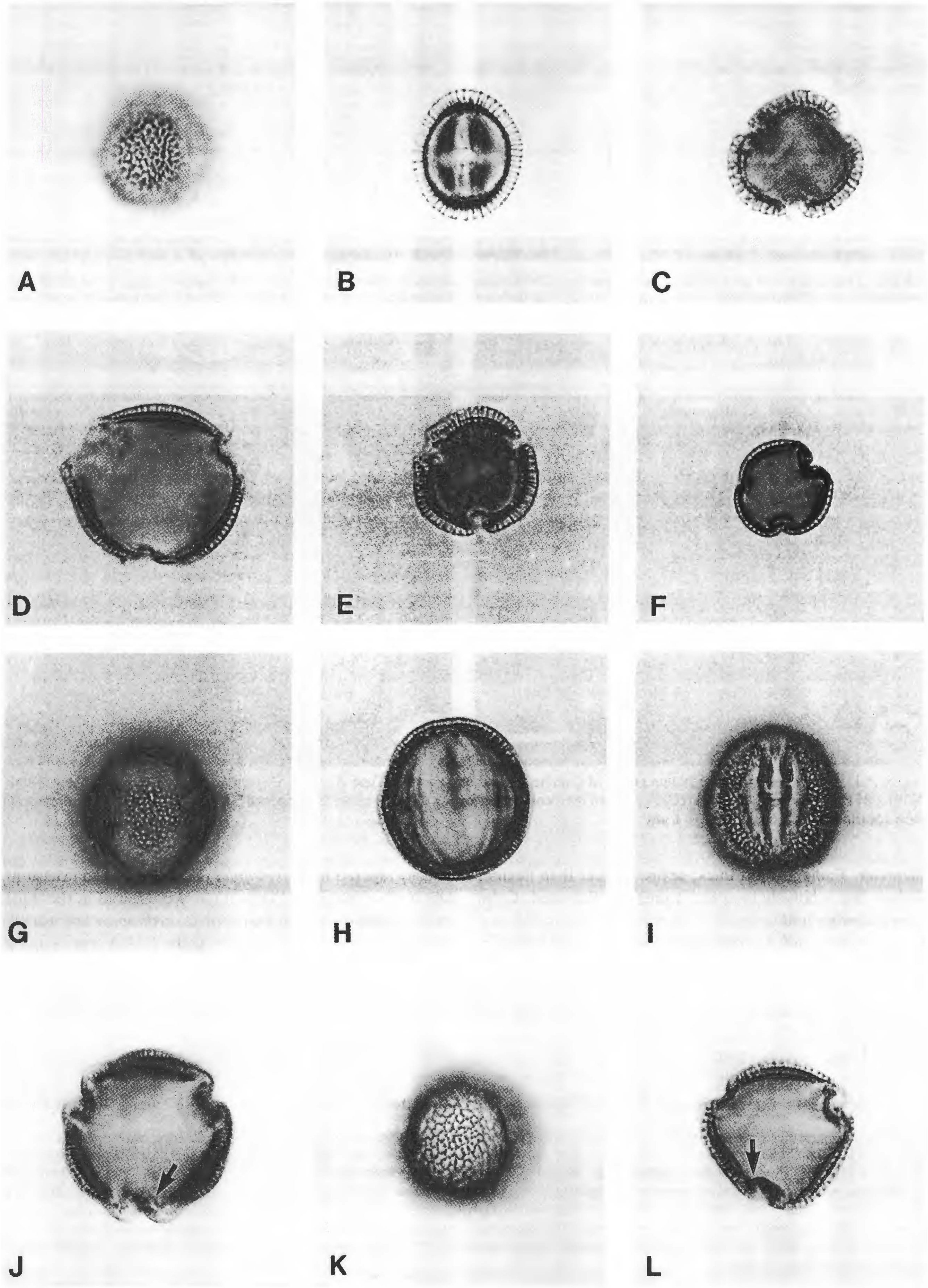

Fig. 4.

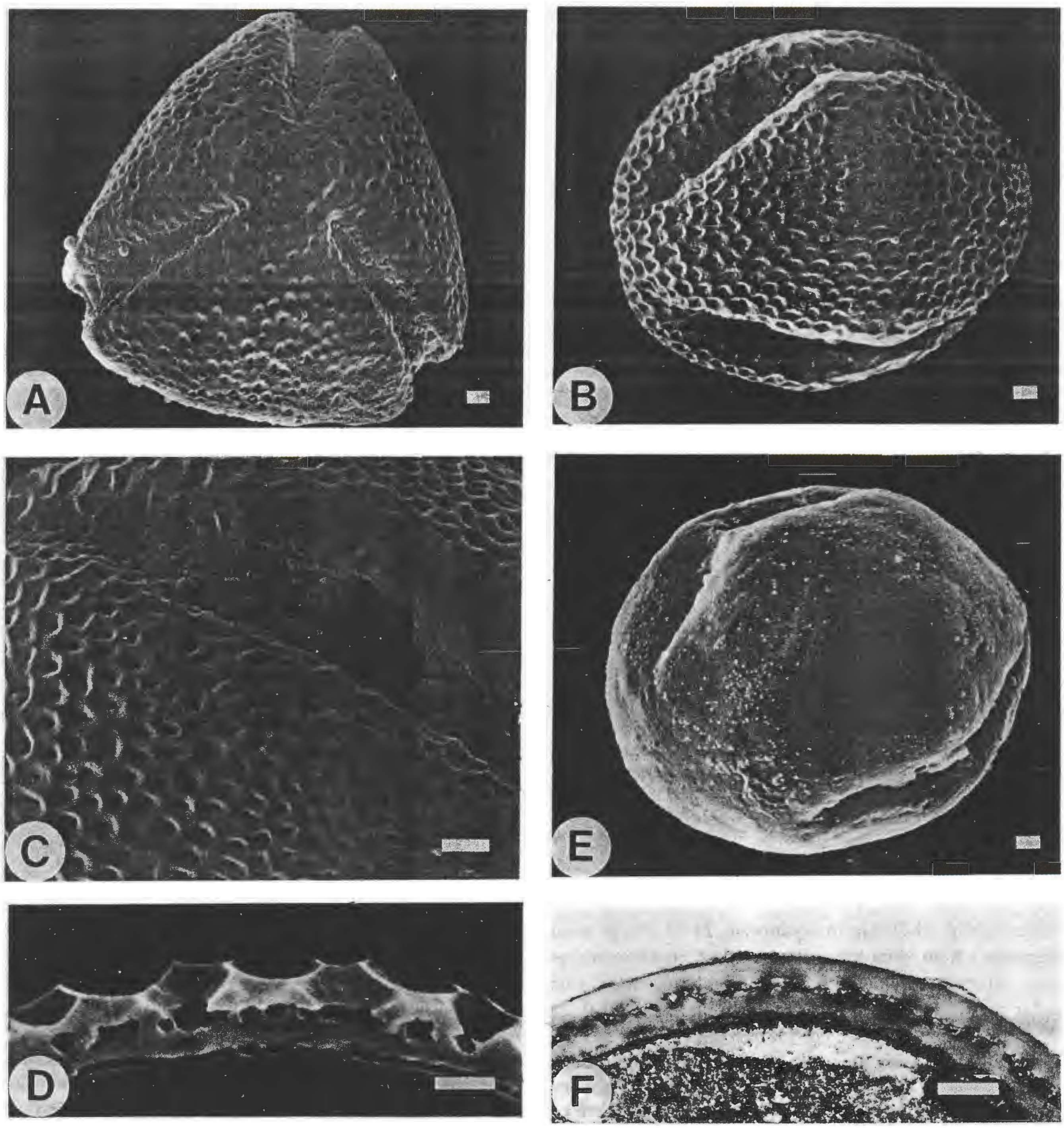

Fig. 5. A-F. SEM and TEM micrographs of pollen grains of *Allocassine* and *Cassine* s.l. (Type B). (A) *A. laurifolia*, polar view (Van Wyk 5056). B-D. *C. reticulata* (Marais 387). (B) Equatorial view. (C) Equatorial view with aperture. (D) Thick section of portion of mesocolpium. E, F. *C. tetragona*. (E) Equatorial view, note smooth tectum (Abbott 429). (F) TEM micrograph of portion of mesocolpium showing weakly developed columellae (Archer 307). Scale lines = 1 μm.

foveolate (holes/lumina variable as to density and size), or nearly smooth, gradually merging with colpus membrane; muri (when distinct) usually rounded. Exine 2–3 μm thick; sexine and nexine of equal thickness. Columellae very short (ca. 0.2 μm), decreasing in length towards the colpi. Colpi with endexine fold inconspicuous, except in *Allocassine* (Fig. 6F).

Species included: *C. reticulata* (Figs. 5B-D; 6D, E), *C. tetragona* (Figs. 5E, F; 6A-C) and *Allocassine laurifolia* (Figs. 5A, 6F).

The tectum surface of *C. tetragona* is almost smooth and irregularly foveolate (Fig. 5E, F), whereas in the other two species it is regularly foveolate with ± rounded 'muri' (Fig. 5A-D).

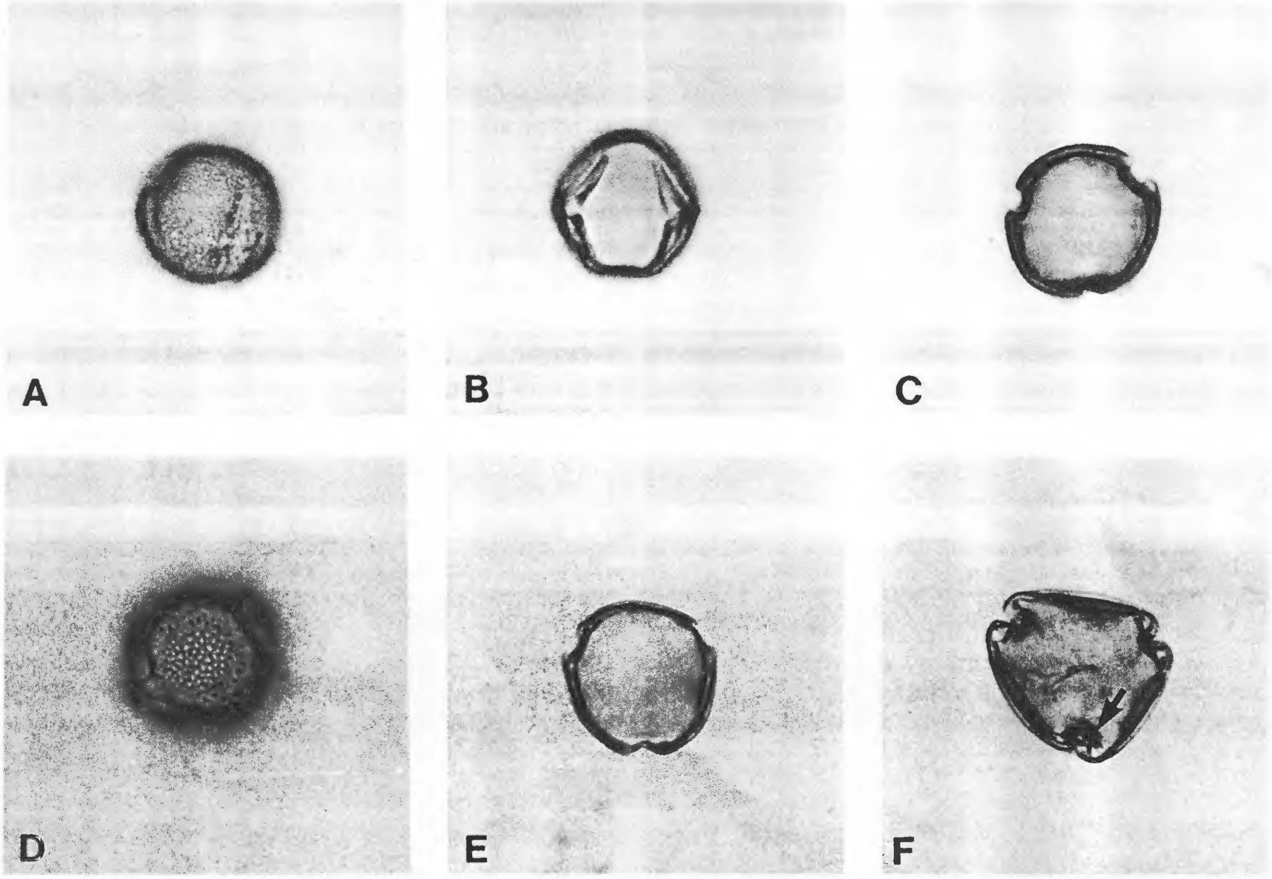

Fig. 6. A-F. Light micrographs of *Cassine* s.l. and *Allocassine* (Type B). A-C. *C. tetragona*. (A) Equatorial view showing smooth surface structure (Bohnen 4901). (B) Equatorial view, optical cross section (Abbott 429). (C) Polar view, optical cross section (Bohnen 4901). D, E. *C. reticulata* (Geldenhuys 1033). (D) Equatorial view showing surface structure. (E) Polar view, optical cross section. F. *A. laurifolia*, polar view, optical cross section (Kemp 1334). Arrow showing endexine fold. All magnifications at X1000.

Type C (rugulose-reticulate grains)

Pollen grains 20–29 μm in equatorial, 24–32 μm in polar diameter. Amb semi-triangular. Tectum rugulose-reticulate, abruptly merging with colpus membrane. Muri with outer edges rounded, 0.3–1.0 μm high; lumina 0.5–1.0 μm diameter. Exine 2–3 μm thick; sexine thicker than nexine. Columellae relatively long (ca. 1 μm). Colpi with endexine fold.

Species included: *C. crocea* (Figs. 7G; 8A, B; 9E, F), *C. matabelicum* (Figs. 7A, B; 9A-D), *C. schlechteriana* (Fig. 8C, D) and *C. transvaalensis* (Fig. 7C-F).

No constant interspecific differences were found in the material studied. The exine sculpture depicted for one sample of *C. transvaalensis* (Fig. 7C) is rather unusual for the species. This is probably an aberrant form since all the other samples showed the surface patterning as in Fig. 7D.

DISCUSSION

In the southern African fleshy-fruited Celastraceae pollen characters proved to be fairly constant on the species level, with variation in exine structure and surface patterning particularly useful for the recognition of pollen types. The three pollen types recognized are to some extent congruent with supraspecific groups (Table I) based on a wide spectrum of taxonomic evidence (Archer 1990). Grain size, however, did not appear to be taxonomically significant, although type C pollen grains tended to be slightly larger than those of the others. Dimensional variation of the pollen grains studied is well within the limits previously recorded for *Cassine* s.l. (Lobreau-Callen 1977, Rasoarimalala et al. 1982).

Among the taxa with type A pollen, most species can be told apart by slight variation in exine surface patterning. Similar pollen grains are, however, widespread in Celastraceae s. str. and Hippocrateaceae (Van Campo & Hallé 1959, Lobreau-Callen 1975*a*, 1977, also unpublished data). Possession of this general pollen type does therefore not necessarily signify close taxonomic affinity, particularly at generic level. If anatomical and macromorphological evidence are also considered (Archer 1990), it is obvious that the studied group of species with pollen type A comprises a heterogeneous assemblage, including members of the generic segregates *Cassine* s. s., *Elaeodendron*, *Maurocenia*

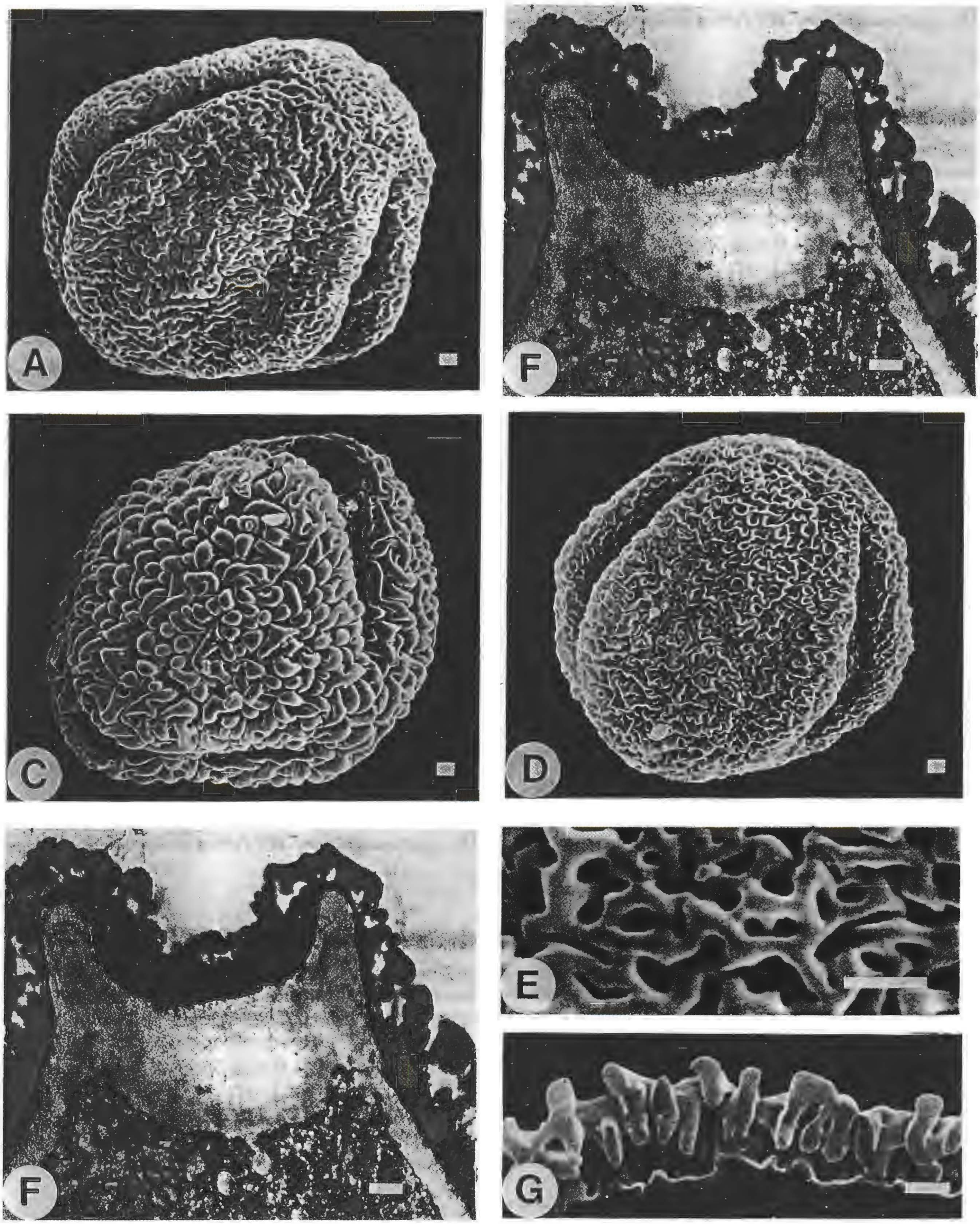

Fig. 7. A-G. SEM and TEM micrographs of pollen grains of *Cassine* s.l. (Type C). A, B. *C. matabelicum*. (A) Equatorial view (Miller B/919). (B) Equatorial view showing aperture (Gibbs 365). C-F. *C. transvaalensis*. (C) Equatorial view (Huntley 998). (D) Equatorial view (De Winter 3706). (E) Equatorial view showing detail of exine (De Winter 3706). (F) TEM micrograph of portion of colpus (Archer 467). (G) *C. crocea*, thick section of portion of mesocolpium, showing irregular muri (Story 1267). Scale lines = 1 μm.

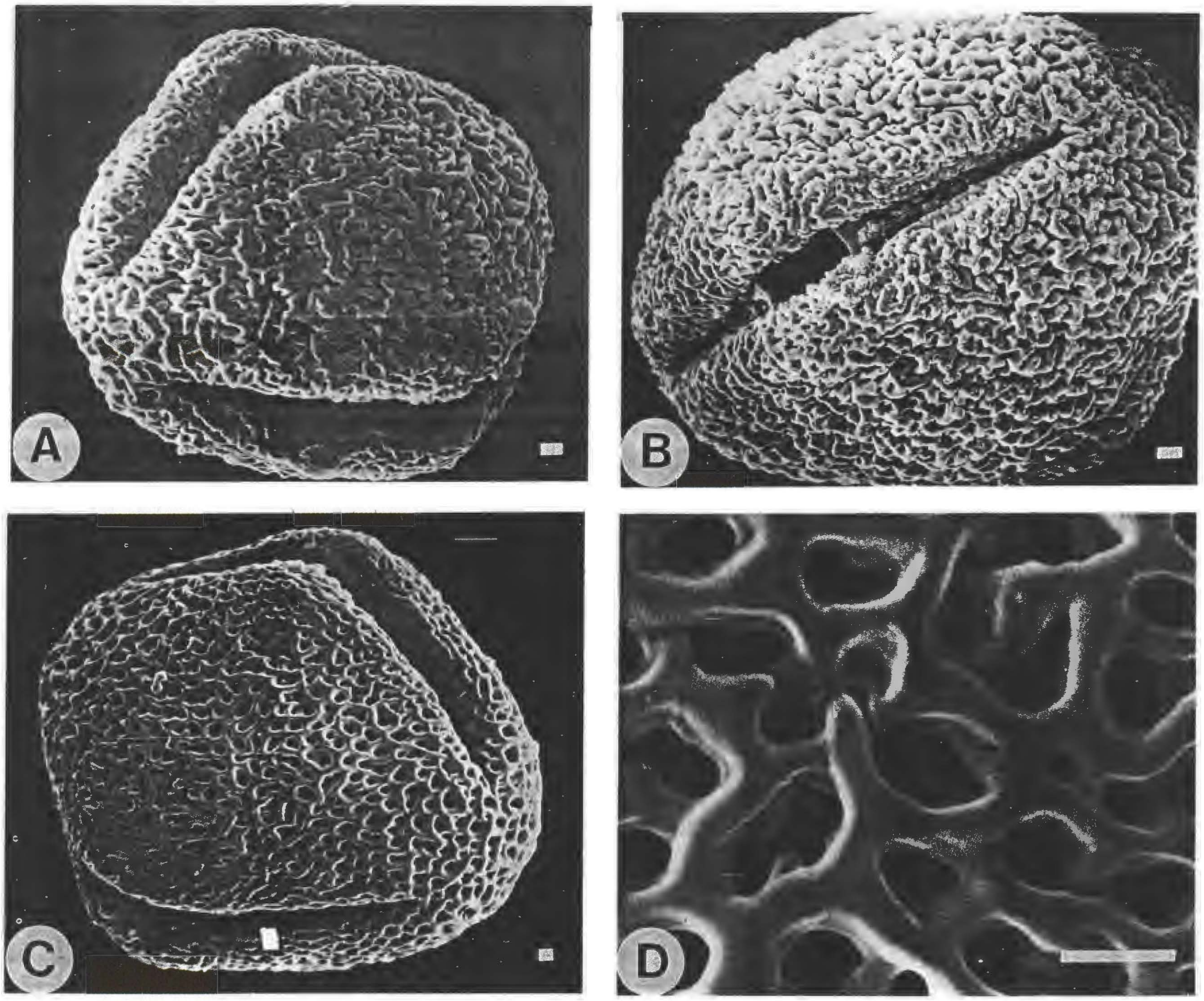

Fig. 8. A-D. SEM micrographs of pollen grains of *Cassine* s.l. (Type C). A, B. *C. crocea* (Story 1267). (A) Equatorial view. (B) Equatorial view with aperture. C, D. *C. schlechteriana* (Sousa 2774). (C) Equatorial view. (D) Portion of mesocolpium, showing rugulose-reticulate exine. Scale lines = 1 µm.

and *Mystroxylon* (Table I). The criteria used by Lobreau-Callen (1975*a*) for the recognition of two pollen types could be applied to subdivide the taxa with pollen type A, but the resultant groups still would clearly not be natural entities. More pollen samples of *C. eucleiformis* and *C. maritima* should be studied (particularly by TEM) to fully assess the taxonomic significance of relatively thin walls recorded in the present study.

Although poorly developed in a few taxa, the presence of an endexine fold in the aperture (also referred to as apertural replication or conduplication) has heretofore been noted in all members of the Celastraceae s. s., and is considered a feature characteristic of the Celastrales (e.g. Van Campo & Hallé 1959, Guinet 1962, Lobreau-Callen 1973, 1975*b*, 1976). The lack of such a fold was, however, reported in *Hippocratea* (Lobreau-Callen 1977). The generaly poor development of apertural conduplication, associated with a foveolate to psilate tectum surface in type B pollen, is therefore considered taxonomically significant. *Allocassine* is provisionally included under pollen type B, although it could be removed on the basis of its well developed endexine fold. This pollen type supports the recognition of the genera *Allocassine* and *Lauridia*, both distinguished from each other (in addition to the endexine fold in the former) by several morphological and anatomical characters (Archer 1990).

Type C pollen is very distinctive with a rugulose-reticulate exine structure not previously noted in Celastraceae. It supports Robson's (1965) treatment of *C. crocea* and *C. transvaalensis* under the genus *Crocoxylon*. Pollen of *C. matabelicum* and *C. schlechteriana*, placed by Robson (1965, 1966) in *Elaeodendron*, closely resembles pollen type C. Hence the genus *Crocoxylon* is considered a well defined natural group comprising these four southern African species. It also differs from related genera in floral structure as well as several anatomical features (Archer

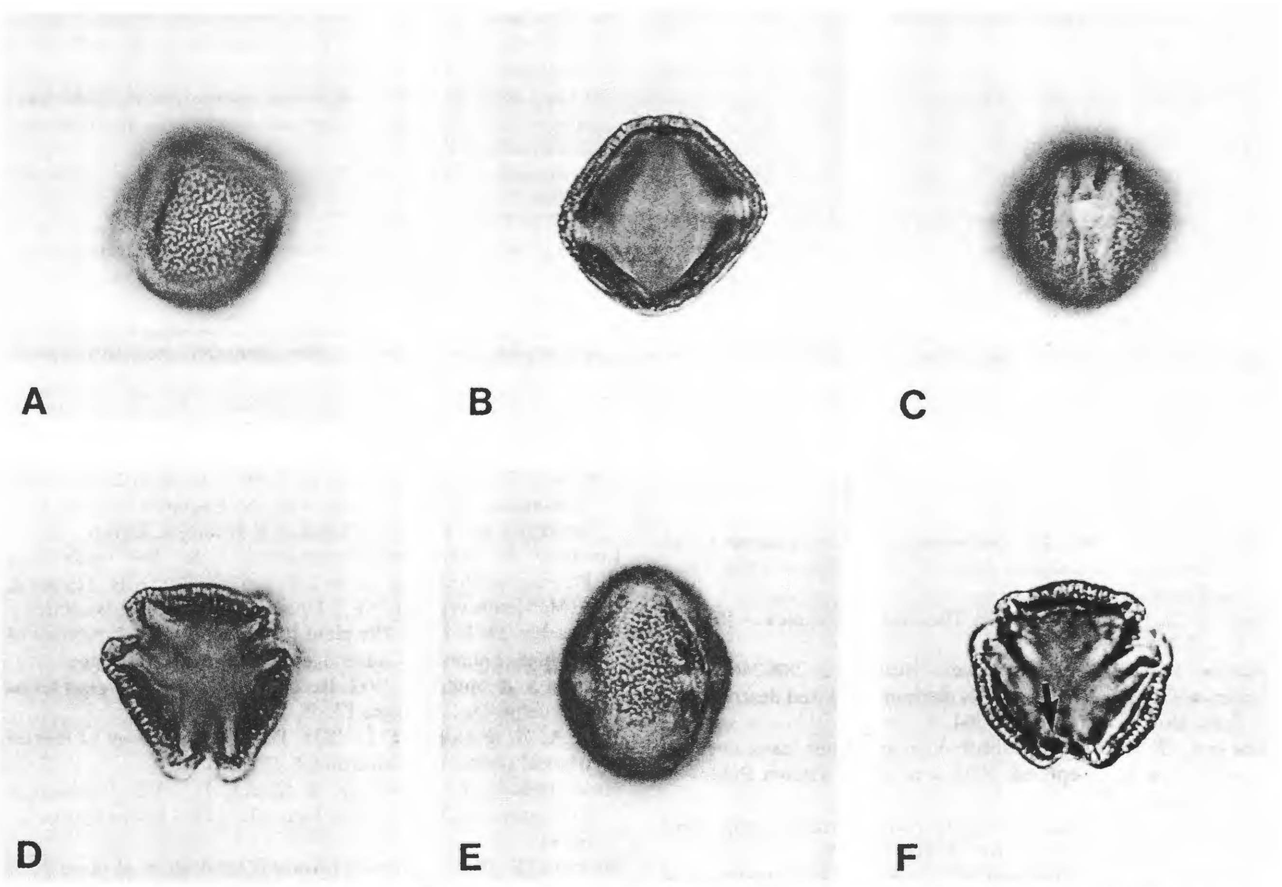

Fig. 9. A-F. Light micrographs of *Cassine* s.l. (Type C). A-D. *C. matabelicum* (Plowes 1640). (A) Equatorial view showing surface structure. (B) Equatorial view, optical cross section. (C) Equatorial view, showing aperture. (D) Polar view, optical cross section. E, F. *C. crocea* (Story 1267). (E) Equatorial view showing surface structure. (F) Polar view, optical cross section. Arrow showing endexine fold. All magnifications at X1000.

1990). Although previously studied at the LM level, pollen grains of *Cassine crocea* were not considered particularly noticeable by Lobreau-Callen (1974, 1975*a*).

This study indicates that, despite its claimed stenopalynous nature (Erdtman 1966), pollen morphology of the Celastraceae could be sufficiently variable to at least contradict current inclusive generic concepts among some southern African members of the family. The SEM has made possible a major advance in the study of celastraceous pollen grains by clearly resolving features that often cannot be seen, accurately measured, or described using the LM. There is a need for the data-base upon which comparisons can be based to be considerably expanded. New characters of the pollen grains of Celastraceae, as revealed especially by the SEM, could be helpful in refining existing generic classifications as well as in classifying taxa of which the relationships are still unknown or controversial.

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SPECIMENS INVESTIGATED

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Cassine aethiopica Thunb. Cooper 127 (PRE), Klopper 60 (PRU), Van der Schijff 6587 (PRU), Von Teichman 344 (PRU).

C. barbara L. Hugo 1698 (PRE), Leighton 1056 (PRE), Thompson 3600 (PRE).

C. burkeana Kuntze. Van Rooyen 2228 (PRU).

C. crocea (Thunb.) Kuntze. Acocks 8989 (PRE), Sim 2120 (PRE), Story 1267 (PRE).

C. eucleiformis (Eckl. & Zeyh.) Kuntze. Bremekamp & Schweickerdt 416 (PRU), Galpin 13348 (PRE), Gerstner 3238 (PRE).

C. maritima (H. Bol.) L. Bol. Fourcade 3273 (PRE), White 5117 (PRE).

C. matabelicum (Loes.) Steedman. Gibbs 365 (PRE), Miller B/919 (PRE), Miller 1918 (PRE), Plowes 1640 (PRE).

C. papillosa (Hochst.) Kuntze. Deall 2279 (PRE), Scheepers 675 (PRE), Van Wyk 4601 (PRU).

C. parvifolia Sond. Hutchinson 611 (PRE), Oliver 3947 (PRE), Taylor 5961 (PRE).

C. peragua L. Abbott 1888 (PRU), Cattell 242 (PRE), Nicholson 2084 (PRE), Taylor 8461 (PRE).

C. reticulata (Eckl. & Zeyh.) Codd. Geldenhuys 1033 (PRE), Marais 387 (PRE), Story 516 (PRE).

C. schlechteriana (Loes.) Loes. Gomes & Sousa 4435a, 4696 (PRE), Sousa 2774 (PRE).

C. tetragona (L. f.) Loes. Archer 306 (PRU), Abbott 429 (PRU), Bohnen 4901 (PRE), Kluge 429 (PRE), Tyson 17115 (PRE), Van Wyk 8118 (PRU).

C. transvaalensis (Burtt Davy) Codd. Archer 467 (PRU), De Winter 3706 (PRE), Edwards 2911 (PRE), Huntley 998 (PRE).

Hartogiella schinoides (Spreng.) Codd. Marais 704 (PRE), Viviers 1301 (PRE).

Maurocenia frangularia (L. f.) Mill. Marloth 5978 (PRE).

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APPENDIX 7

BARK STRUCTURE AND INTERGENERIC RELATIONSHIPS OF SOME SOUTHERN AFRICAN CASSINOIDEAE (CELASTRACEAE)*

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BARK STRUCTURE AND INTERGENERIC RELATIONSHIPS OF SOME SOUTHERN AFRICAN CASSINOIDEAE (CELASTRACEAE)

by

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Summary

At present *Cassine* in southern Africa is treated in a wide sense (s.l.), including amongst others *Allocassine* p.p., *Cassine* s.str., *Crocoxylon, Elaeodendron, Lauridia,* and *Mystroxylon.* A comparative anatomical study was made of mature bark representing 16 southern African species of *Cassine* s.l., and the monotypic *Allocassine, Hartogiella* and *Maurocenia* (all members of the subfamily Cassinoideae). Six bark types are distinguished on the basis of the type of sclerenchymatous elements in the secondary phloem; presence or absence of styloid crystals, elastic threads, and sclerified phelloderm; stratified homogeneous phellem; and degree of rhytidome development. These correlate to a considerable extent with the generic subdivision of *Cassine* s.l. proposed by Loesener (1942) and Robson (1965). On the basis of bark anatomy and other evidence, it is proposed that the circumscription of *Cassine* be restricted to include only the southern African species *C. peragua* and *C. parvifolia,* and possibly *Hartogiella. Crocoxylon, Elaeodendron, Lauridia* and *Mystroxylon* should be reinstated or maintained, although with some modification of the originally defined generic limits.

Key words: systematic bark anatomy, taxonomy, *Cassine* s.l., Cassinoideae, Celastraceae.

Introduction

This study forms part of a multidisciplinary approach towards a taxonomic revision of the southern African members of subfamily Cassinoideae (Archer 1990; Archer & Van Wyk 1992). Established by Loesener (1892), this subfamily accommodates those species of Celastraceae with indehiscent fruits, usually drupes or berries.

There is considerable diversity of opinion regarding the delimitation and recognition of genera among the species of *Cassine* s.l. Various authors (Loesener 1894, 1942; Robson 1965, 1966) advocate smaller, more homogeneous genera, while Davison (1927), Hou (1962), Codd (1966), Kostermans (1986) and current herbarium practice at the National Herbarium, Pretoria (PRE) (Gibbs Russell et al. 1987), prefer to treat *Cassine* in a wide sense, so as to include *Allocassine* p.p., viz. *A. tetragona, Crocoxylon, Elaeodendron, Lauridia,* and *Mystroxylon.* For the last two decades the treatment of *Cassine* in a broad sense has received strong support worldwide (e.g. Dyer 1975; Mabberley 1987; Jessup 1984). The accumulation of new evidence from morphology and anatomy, as well as other sources, might accomplish a better understanding of generic limits in the Celastraceae.

Comparative bark anatomical studies on members of the Celastraceae are scanty. Roth (1973, 1981) describes the bark anatomy of woody neotropical species of Celastraceae. Zahur (1959), in a comprehensive survey of secondary phloem structure in dicotyledons, studied a few species of Celastraceae, but the anatomical description of this family was apparently accidentally omitted from this publication. Observations on celastraceous bark structure have also been provided by Weber (1913), Thorenaar (1926) and Chung & Park

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(1975). However, no information on the anatomical structure of the bark of *Cassine* could be found in the literature.

As an aid towards the classification of woody taxa, the potential taxonomic significance of bark anatomy has been neglected. The bark anatomy of celastraceous species hitherto investigated by us, suggests that bark structure could contribute considerably towards the delimitation of taxa, particularly at the generic level. In southern African Celastraceae, bark structure is often more useful for diagnostic purposes than is wood structure (Archer 1990 & unpublished results).

Because of their ethnobotanical importance, there is a demand for bark anatomical information on African trees. This would facilitate the identification of bark fragments which are extensively traded by traditional healers. Many trees with sought-after barks are vulnerable to overexploitation. A database for the identification of barks is needed, not only for the protection of tree species, but also to exert control over the identity of barks sold or administered to the public. Barks of several species of *Cassine* s.l. are extensively used in traditional medicine, especially those containing conspicuous orange pigments.

In this paper the comparative bark anatomy of the southern African members of the Cassinoideae, comprising *Cassine* s.l. and the three monotypic genera, *Allocassine, Hartogiella* and *Maurocenia* is described and its taxonomic significance assessed. Although placed under the Cassinoideae by Loesener (1892, 1942), *Pleurostylia,* with its dry fruits, is not considered to be closely related to the other southern African Cassinoideae. It has therefore been excluded from this study. Special emphasis is placed on bark features for evaluating previous proposals to subdivide *Cassine* s.l. into several, allegedly more natural, genera (e.g. Loesener 1894, 1942; Robson 1965, 1966).

Materials and Methods

Fifty-three samples of mature bark, from 16 species of *Cassine* s.l., *Allocassine, Hartogiella* and *Maurocenia* were studied using mainly light microscopy. Voucher specimens are housed in the H.G.W.J. Schweickerdt Herbarium (PRU) and listed under Results.

Bark samples were removed at approximately 0.5 m height from vertical boles not less than 100 mm in diameter, and fixed in FAA (Johansen 1940). Standard procedures for wood anatomy were used to prepare transverse, radial and tangential sections, 15–20 μm thick, from unembedded bark samples on a Reichert sliding microtome. These were supplemented by hand-cut sections.

Sections were double stained in safranin O and fast-green FCF (Johansen 1940), and mounted permanently in entellan (Art. 7961, E. Merck, Darmstadt). The phloroglucinol/hydrochloric acid test and Sudan black B were used for detecting lignin and suberin respectively (Jensen 1962).

Hand-cut sections of the non-collapsed secondary phloem, mounted in resorcin blue (O'Brien & McCully 1981) or aniline blue (Eschrich & Currier 1964), were viewed using bright-field and fluorescence optics to examine sieve plates. Macerates of a few samples were prepared with Schulze's solution (McLean & Ivimey-Cook 1941).

Drawings were made using a camera lucida. Observations of the rhytidome pose a problem because its brittleness causes it to be easily torn apart and lost during sectioning. To study this tissue, clean-cut pieces of bark were examined under a dissecting microscope (Van Wyk 1985). Histochemical testing for lignin was carried out by applying phloroglucinol/hydrochloric acid directly to the bark surface.

Descriptive terms follow Whitmore (1962a, b), Roth (1981) and Van Wyk (1985). The definition of inner bark follows Whitmore (1962a). Terminology of the various sclerenchymatous elements follows the proposals of Parameswaran (1980). The terms conducting and non-conducting phloem were replaced by non-collapsed and collapsed phloem respectively as suggested by Trockenbrodt (1990).

Results

Barks of the investigated species can be grouped into six distinct anatomical types. The principal structural differences between the types are summarised in Table 1. Descriptions of the various bark types, as well as the details of the taxa in which they are found, are given below.

Table 1. Summary of the diagnostic bark anatomical features in the six bark types recognised (+ = present; – = absent).

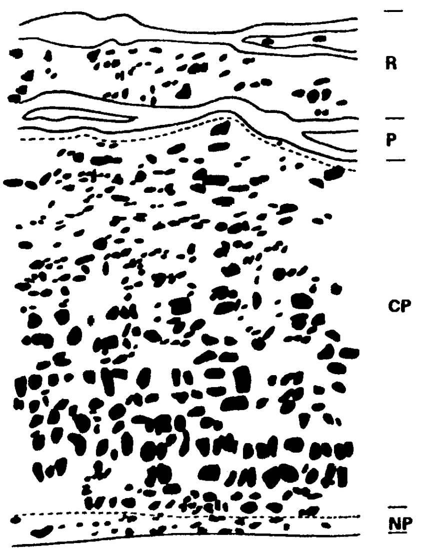
Genera proposed by Archer (1990):	*Elaeodendron* & *Crocoxylon*	*Mystroxylon*	Genus A	*Cassine* s.str. & *Hartogiella*	*Allocassine*	*Lauridia* & *Maurocenia*
Bark type:	A1	A2	B	C	D	E
Sclerenchyma						
Large primary sclereids	+	+	–	–	–	–
Fibres	–	–	–	+	+	–
Sclerenchyma absent in both non-collapsed and collapsed phloem	–	–	+	–	–	–
Chambered crystalliferous sclereids	–	–	–	–	+	+
Crystals and other features						
Styloids	–	–	+	–	–	–
Septate crystal strands	–	–	–	–	–	+
Elastic threads	–	–	+	–	–	–
Cell width of widest phloem rays (near cambium)	6	6	4	3	1 (2)	1 (2)
Periderm						
Sclerenchymatous phelloderm	+	–	–	–	–	–
Number of periderm layers	2–5	2–3	2–3	2–3	1	3–8
Persistent periderm	–	–	–	–	+	–

Bark type A1 (Figs. 1, 7, 9, 10, 15, 16, 23, 24)

Diagnostic characters: Large fibre-sclereids and/or sclereids abundant throughout the secondary phloem; sclereids in the non-dilating phloem often clustered in fusiform groups (radial longitudinal section), also in the dilatation zone (transverse section); phelloderm crystalliferous and weakly sclerified, the latter elements irregularly arranged, or in a more or less continuous ring; rhytidome well developed.

Material studied: Cassine crocea (Thunb.) Kuntze (alternatively placed under *Crocoxylon* Eckl. & Zeyh.): Archer 303, 312, 366. – *C. matabelicum* (Loes.) Steedman (alternatively placed under *Elaeodendron* Jacq. f.): Venter & Archer 184, 185. – *C. papillosa* (Hochst.) Kuntze (alternatively placed under *Elaeodendron*): Archer 217, 224, 344. – *C. transvaalensis* (Burtt Davy) Codd (alternatively placed under *Crocoxylon*): Archer 215, 222, 245, 246, 325, Pienaar & Archer 1338.

General: Bark surface longitudinally fissured; fissures narrow to broad, often cutting deep into the rhytidome layers. Bole grey to brown, recently sloughed off flakes exposing bright orange patches of new periderm in *C.*



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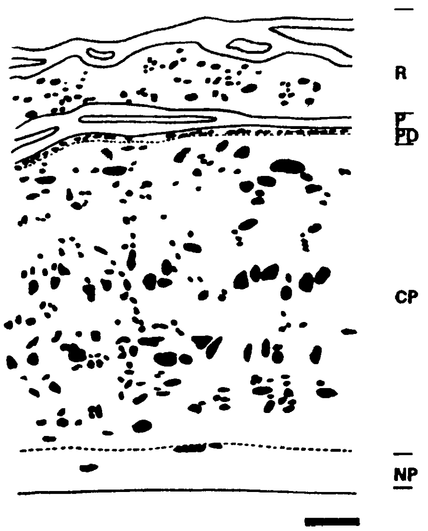

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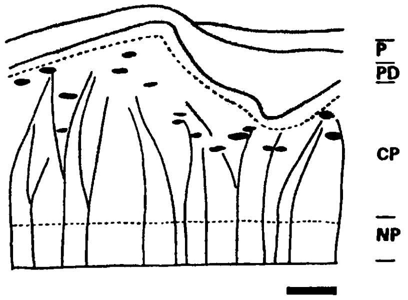

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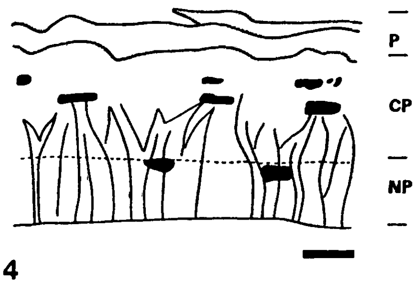

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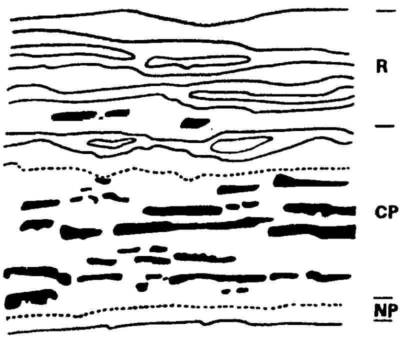

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papillosa and *C. crocea*. Orange pigment also visible when the outer bark surface is lightly scraped; pigment absent or barely visible in *C. transvaalensis*. Slash red to pinkish, with a narrow greenish zone just inside the last-formed periderm. Inner bark width (sensu Whitmore 1962a, b; Van Wyk 1985) (3–)5–10(–13) mm.

Anatomy: Sieve elements abundant, occurring as narrow radial rows between the rays, usually obliterated in the collapsed phloem. Sieve plates strongly oblique; sieve areas 7–29 per plate, equally spaced. Sieve areas occasionally present on the lateral walls. Transverse to oblique anticlinal partitions common, 2–4 per sieve element (secondary septation of Zahur 1959). Companion cells narrow, occurring in short strands often next to the phloem rays. Axial phloem parenchyma not observed or scanty.

Phloem rays heterogeneous, uni- or multiseriate with the procumbent portion 4–6 cells wide (before dilation). Uniseriate margins consisting of 2–5 layers of upright cells. Course of rays more or less straight, before dilating in more or less funnel-shaped patterns.

Fibres absent. Both large primary brachysclereids and fibre-like sclereids (fibre-sclereids) present. Sclereids present from the borderline between the non-collapsed and collapsed phloem, scattered as large individual fusiform cells (fibre-sclereids) or clustered in axially fusiform (radially longitudinal section) and regular round to square (transverse section) groups. Sclereid groups in the collapsed phloem axially elongate; usually arranged in weak concentric layers interrupted by rays in transverse aspect. Secondary sclereid groups in dilatation tissue tangentially expanded owing to lateral proliferation of the rays. Usually with a few sclerenchymatous elements mainly localised in the phelloderm.

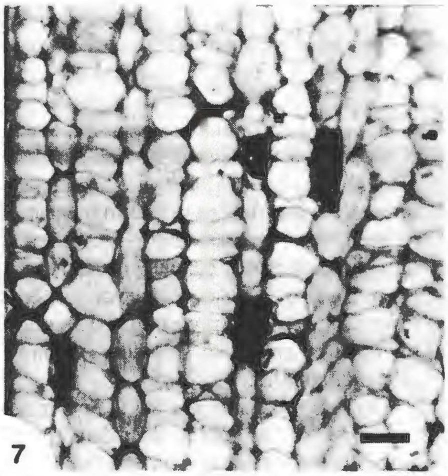
Dilatation tissue either weakly developed as an irregularly widening of the rays owing to tangential enlargement and multiplication of ray cells, or, more usually, well developed as a broad continuous band of dilatation tissue beneath the last-formed periderm (henceforth referred to as pseudocortex) in most samples. Composed of mainly parenchyma cells which often tend to form conspicuous tangential rows. Large tangentially elongated secondary sclereids or groups of sclereids (secondary sclereids) present.

Crystals prismatic; present in rays in non-collapsed phloem, and in the dilated rays of the collapsed phloem. Crystalliferous cells often present in the phelloderm.

Periderms usually 2–5, formed sequentially as discontinuous layers connected to the older layers and usually overlapping. Periderms continuous and curved, completely separating living tissues from dead. Phellem stratified, usually composed of 2–5 layers of cells with pinkish stained (safranin/fast-green) tanniniferous contents alternating with 1 or 2 layers of empty cells. In *C. transvaalensis* composed of weakly defined layers of cells with slightly thickened radial walls (stained red with safranin/fast-green) alternating with uniseriate layers of thin-walled cells. Phelloderm parenchymatous with scattered sclereids, assembled in irregularly shaped groups or in a weakly developed sclerenchymatous ring or rings to the inside of the phelloderm. Crystalliferous cells often present.

Rhytidome nearly always present, consisting of (1–)2–4(–6) superposed sheet-like layers, each 0.5–2.0 mm thick; each new periderm taking a deep course thereby producing a thick rhytidome layer.

Figs. 1–6. Schematic presentation of bark types, transverse section, sclerenchyma shown in black. – 1: Bark type A1, *Cassine transvaalensis* (Archer 215). – 2: Bark type A2, *C. aethiopica* (Archer 244). – 3: Bark type B, *C. maritima* (Archer 277). – 4: Bark type C, *C. peragua* (Van Jaarsveld 10581). – 5: Bark type D, *Allocassine laurifolia* (Van Wyk 8307). – 6: Bark type E, *C. reticulata* (Van der Walt s.n.). — Scale bars = 1 mm. — NP = non-collapsed phloem; CP = collapsed phloem; P = phellem; PD = phelloderm; R = rhytidome.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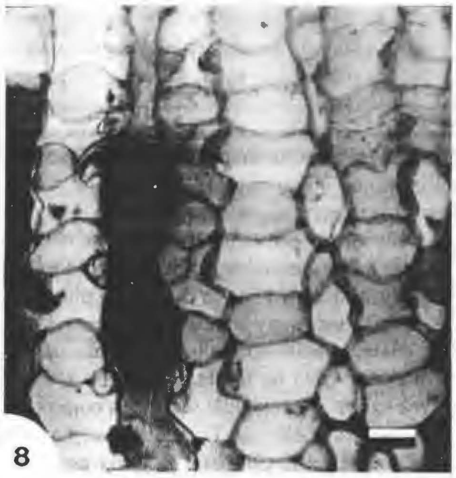
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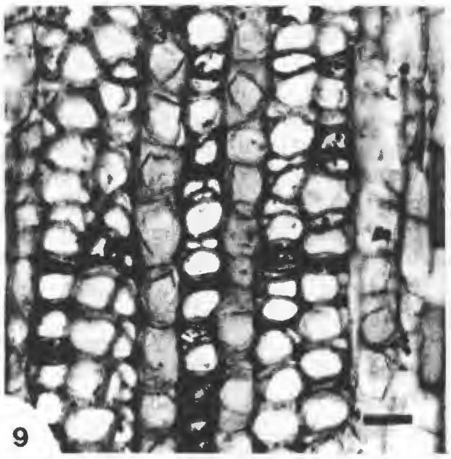
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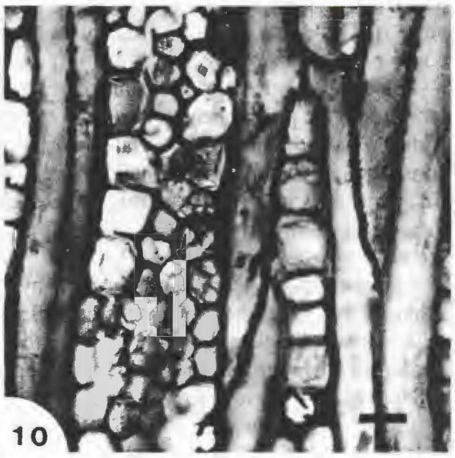
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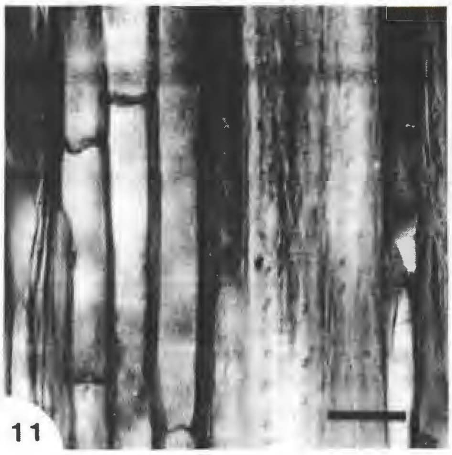
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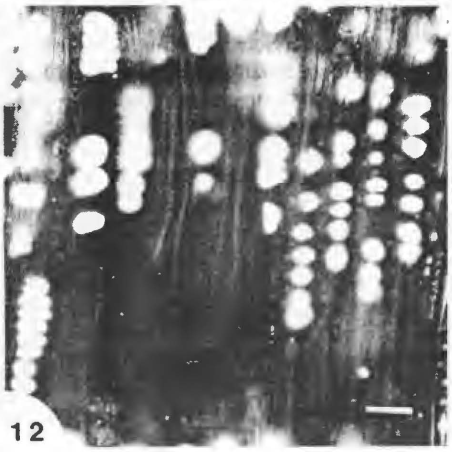
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Bark type A2 (Fig. 2)

Diagnostic characters: Secondary sclereids relatively large, present throughout the secondary phloem (rare in non-collapsed phloem); phelloderm parenchymatous, very rarely sclerified (with isolated secondary sclereids) or crystalliferous; rhytidome well developed.

Material studied: Cassine aethiopica Thunb.: Archer 212, 244, 247, 272, 324, 327, 379. – *C. burkeana* Kuntze: Archer 210, 211. These taxa previously included in *Mystroxylon* Eckl. & Zeyh. sect. *Eumystroxylon* Loes.

General: Surface longitudinally and transversely fissured; fissures narrow to broad, often cutting deep into the rhytidome layers. Bole grey. Orange pigment not observed but lichens usually present. Slash red to pinkish, with a narrow greenish zone just inside the last-formed periderm. Inner bark width (3–) 5–8(–10) mm.

Anatomy: Sieve elements with 6–19 sieve areas per plate, and copious slime present in the non-collapsed phloem. Otherwise as in bark type A1. Axial phloem parenchyma present, inconspicuous, occurring in short strands of axially elongated thin-walled cells.

Phloem rays heterogeneous, uni- or multiseriate with the procumbent portion 3–6 cells wide. Uniseriate margin with up to 5 upright cells. Course of rays more or less straight, before dilating in irregular funnel-shaped structures. Starch grains often present in ray cells.

Sclereids confined mainly to the collapsed phloem and dilatation zone; scattered as giant solitary cells (primary brachysclereids), or in densely packed axially elongated (compact and round in transverse section) groups. Sclereids often crystalliferous. Secondary sclereid groups in dilatation tissue tangentially elongated (transverse section). Phelloderm not sclerified, rarely with isolated sclereids.

Dilatation tissue well developed as a pseudocortex. Large isolated secondary sclereids or tangentially elongated sclereid groups (groups more or less round in radial longitudinal section), abundant. Strongly tanniniferous.

Crystals prismatic; present in rays of non-collapsed phloem, and abundantly so in the collapsed phloem, occasionally in sclereids. Virtually absent in phelloderm.

Periderms usually 2–5, well developed, formed sequentially as discontinuous layers connected to older layers and usually overlapping. Periderms continuous and curved, completely separating living tissues from dead. Structure of rhytidome obscured owing to inconspicuous periderm cells. Phellem not stratified, consisting of compressed cells with red (safranin/fast-green stained) walls. Phelloderm parenchymatous, usually tanniniferous with few isolated secondary sclereids and crystals scanty or absent.

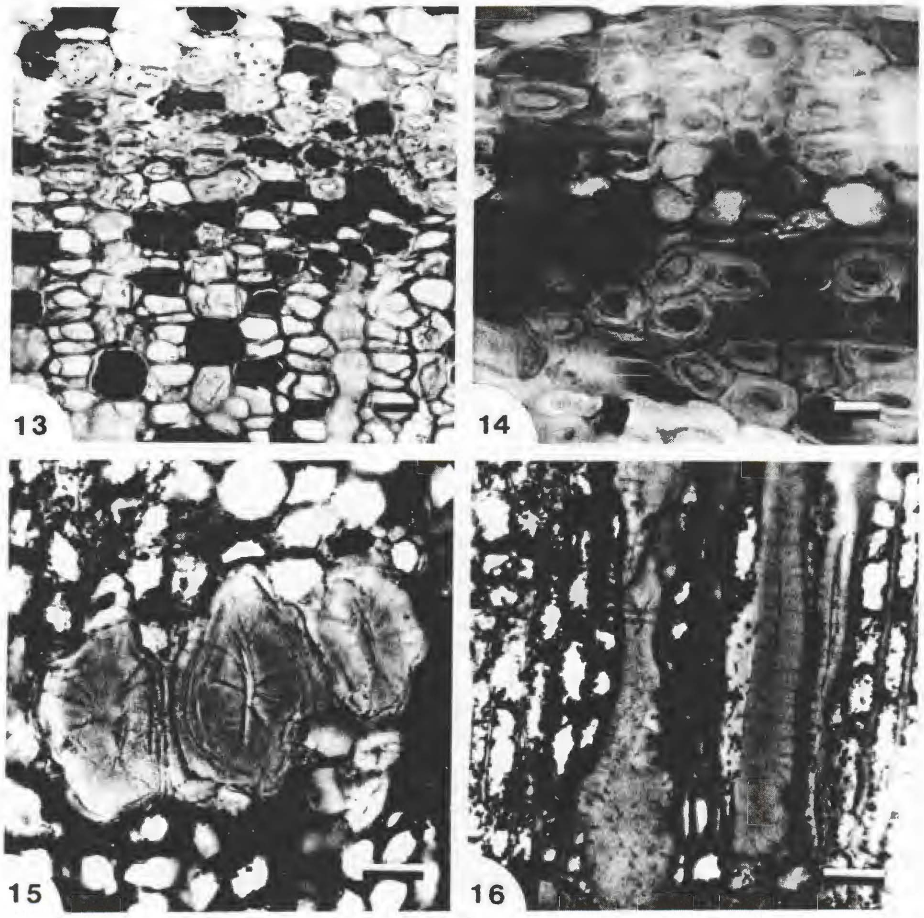
Rhytidome well developed, consisting of (1–)2–4(–6) superposed sheet-like layers, each 0.5–2.0 mm thick; each new periderm taking a deep course thereby producing a thick rhytidome layer. Periderm usually winds round sclerenchymatous elements.

Bark type B (Figs. 3, 20)

Diagnostic characters: Crystals present, styloids; elastic threads (trans-1,4 polyisoprene) present throughout non-collapsed and collapsed phloem; sclerenchymatous elements absent in both non-collapsed and collapsed phloem; phellem parenchymatous, rarely crystalliferous.

Material studied: Cassine eucleiformis (Eckl. & Zeyh.) Kuntze: Archer 233, 235, 236, 240. – *C. maritima* (H. Bol.) L. Bol.: Archer 265, 277, Van Greuning 628. These taxa previously included under *Mystroxylon* sect. *Pseudoscytophyllum* Loes.

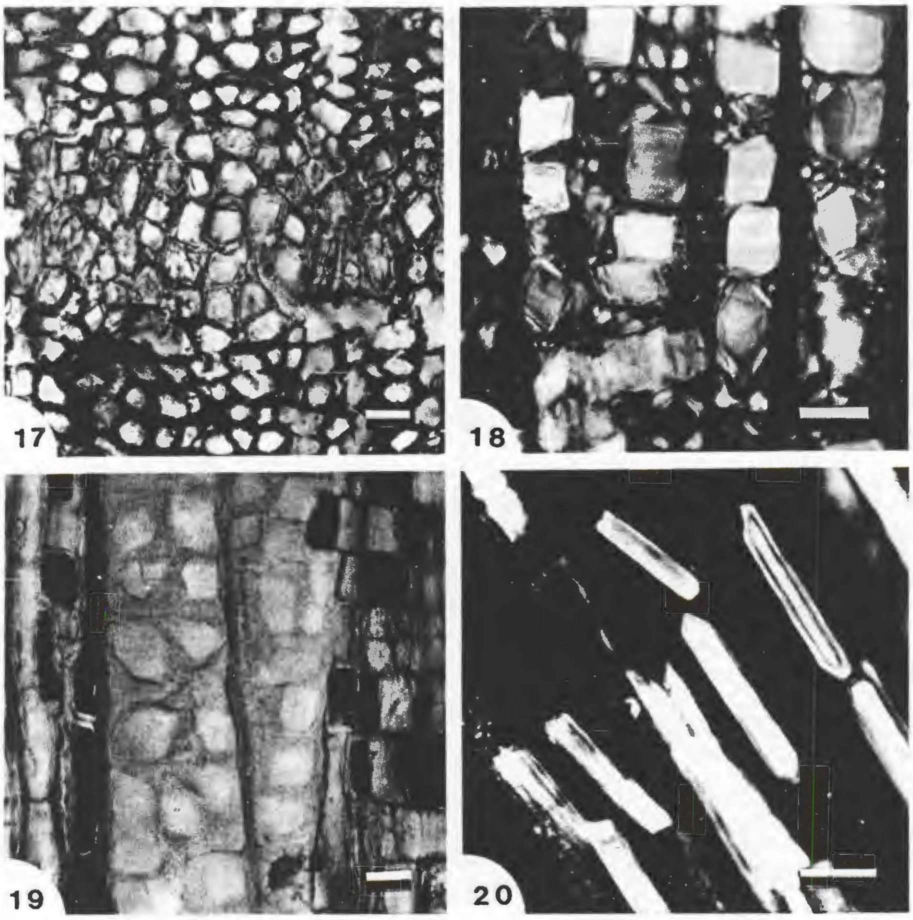
Figs. 7–12. Non-collapsed secondary phloem as seen in transverse and longitudinal section. – 7: *Cassine crocea* (Archer 366), transverse section. – 8: *C. tetragona* (Van Wyk 8276), transverse section. – 9 & 10: *C. transvaalensis* (Pienaar & Archer 1338); 9: transverse section; 10: sieve elements in tangential section, note sieve plates. – 11: *Allocassine laurifolia* (Van Wyk 8307), fibres and septate phloem elements in radial section. – 12: *Maurocenia frangularia* (Archer 261), sieve plates taken under fluorescence optics. — Scale bars = 20 μm.



Figs. 13–16. Sclerenchymatous elements in inner bark. – 13: ***Cassine peragua*** (Van Jaarsveld 10581), fibres in transverse section. – 14: ***Allocassine laurifolia*** (Van Wyk 8307), fibres in transverse section. – 15 & 16: ***Cassine transvaalensis*** (Pienaar & Archer 1338), fibre-sclereids; 15: transverse section; 16: radial section. — Scale bar = 20 µm.

General: Bark surface longitudinally and transversely fissured; fissures narrow to broad, often cutting deep into the rhytidome layers. Bole grey, orange pigment not observed, epiphytic lichens or algae usually present. Slash red to pinkish, with a narrow greenish zone just inside the last-formed periderm. Elastic threads visible when a piece of bark is broken and pulled apart. Inner bark width 2–4 mm.

Anatomy: Sieve areas 7–15 on lateral walls, of various sizes and irregularly arranged. Sieve elements otherwise similar to bark type A1. Elastic threads (trans-1,4 polyisoprene) present when pieces of bark are pulled apart, present in latex tubes in the non-collapsed and collapsed phloem, absent in dilatation tissue. Axial phloem parenchyma scanty, inconspicuous, 3–4(–7) cells per strand. Styloids sometimes present in axial parenchyma cells.

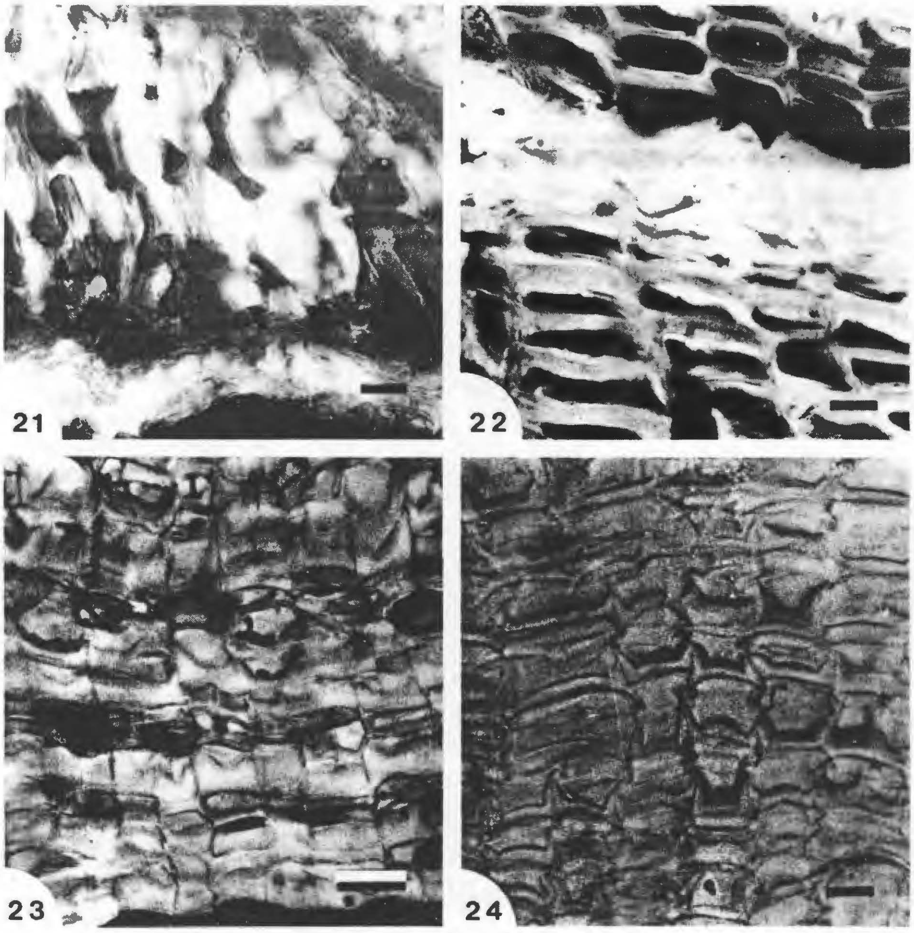


Figs. 17–20. Crystalliferous tissue. – 17 & 18. *Cassine reticulata* (Van der Walt s.n.), lignified chambered crystalliferous strands; 17: transverse section; 18: radial section, under polarised light. – 19: *C. tetragona* (Van Wyk 8276), lignified crystalliferous strands in radial section. – 20: *C. eucleiformis* (Archer 235), styloid crystals in non-collapsed phloem, under polarised light. — Scale bar = 20 µm.

Phloem rays heterogeneous, procumbent portion 2–3(–4) cells wide. Uniseriate margins consisting of 1–3 rows of large upright cells. Short uniseriate rays of upright cells usually present. Styloid crystals often present in upright portion of uniseriate rays and uniseriate margins of multiseriate rays. Ray cells thin-walled and usually tanniniferous; some of the cells tangentially elongate and lignified in the dilatation zone. Course of rays more or less straight, irregularly dilating towards the pseudocortex.

Small solitary secondary sclereids scattered in dilatation tissue in *C. eucleiformis*. Scanty in *C. maritima*. Scattered solitary or irregularly dispersed groups of tangentially elongated secondary sclereids confined to dilating rays and dilatation tissue. Sclereids absent or scanty in phelloderm.

Dilatation tissue well developed, continu-



Figs. 21–24. Phellem structure. – 21: *Cassine parvifolia* (Archer 296), stratified phellem with layers of radially elongated cells. – 22: *C. barbara* (Van Wyk A1138), stratified phellem with layers of phellem cells with thick lignified walls alternating with loosely arranged thin-walled cells. – 23: *C. transvaalensis* (Archer 245), slightly stratified phellem. – 24. *C. papillosa* (Archer 217), homogeneous phellem. — Scale bar = 20 µm.

ous as a pseudocortex beneath the last-formed periderm, inwardly interdigitating with the secondary phloem. Composed mainly of a matrix of parenchyma cells interspersed with solitary or small irregular groups of tangentially dilated secondary sclereids as well as the remains of obliterated phloem elements.

Styloid crystals abundant in the non-collapsed phloem, occurring in axial parenchyma cells, uniseriate rays and margins of multiseriate rays (Fig. 20). Sparsely scattered styloids observed in dilatation tissue. Prismatic crystals also present – apparently replacing the styloids, either randomly distributed or mainly in weak radial lines in dilated rays and pseudocortex. Crystals virtually absent in phelloderm.

Periderms one or more (no well-preserved sample of rhytidome available), sequential periderms as in bark type A1. Phellem not stratified, composed of thin-walled suberised cells usually with tanniniferous contents (stain red with safranin/fast-green; spots of a colourless substance which shows birefringence under polarised light present in *C. eucleiformis*). Phellem thicker and consisting mainly of red-stained tanniniferous phellem cells in *C. maritima*. Phelloderm well developed, parenchymatous, sclereids and crystals scanty or absent.

Rhytidome weakly developed, 1–2 layers observed. Periderm layers appear to break off at a rapid rate.

Bark type C (Figs. 4, 13, 21, 22)

Diagnostic characters: Fibres usually present; phellem usually stratified, layers of cells with thick lignified walls alternating with loosely arranged thin-walled cells; phelloderm parenchymatous, occasionally crystalliferous; bark relatively thin.

Material studied: Cassine barbara L.: Archer 264, Van Wyk A1138. – *C. parvifolia* Sond.: Archer 296, Van Greuning 627. – *C. peragua* L.: Archer 238, 239, 285, Van Jaarsveld 10581, 10583. – *Hartogiella schinoides* (Spreng.) Codd: Archer 251, 252, 258, Van Jaarsveld 10580, 10582.

General: Bark flaky, portions (layers) of rhytidome weathering away, exposing an orange pigment in *C. peragua* and *H. schinoides*; pigment also visible when bark surface is lightly scraped. Orange pigment barely discernible or absent in *C. barbara* and *C. parvifolia*. Slash pinkish red, with a narrow greenish zone just inside the last-formed periderm. Inner bark width 1.5–3 mm.

Anatomy: Sieve areas 3–17(–25) per plate. Sieve elements with up to seven transverse divisions present per element, otherwise similar to bark type A1. Axial phloem parenchyma scanty and inconspicuous.

Phloem rays heterogeneous, procumbent portion 2 or 3 cells wide. Uniseriate margins of 1–3 layers of upright cells. Uniseriate rays of upright cells usually present. Ray cells thin-walled and tanniniferous, often becoming partially lignified adjacent to fibre bundles. Course of rays more or less straight, dilatation more or less funnel-shaped towards the dilatation zone (dilation irregular, with a sharp transition between collapsed phloem and pseudocortex in *C. parvifolia*).

Fibres usually present in non-collapsed and collapsed phloem, often appearing close to the cambium; sometimes with only a single weakly tangentially developed layer of fibres produced close to the vascular cambium. Groups of small isodiametric sclereids present in dilated rays adjacent to fibres or in pseudocortex. Absent or scanty in phelloderm.

Dilatation tissue weakly or well developed.

Crystals prismatic; solitary crystalliferous cells randomly distributed in rays. Occasionally present in phelloderm.

Periderms one or two. Phellem usually stratified, composed of 2–4(–5) weakly defined multiseriate layers of thin-walled suberised cells alternating with 2–5 layers of cells with thick, lignified walls, usually with U-shaped thickenings. Cells with red (safranin/fast-green) tanniniferous substance scattered in phellem. Stratified cork with radially elongated thin-walled cells present in some samples of *C. barbara* and *C. parvifolia*. Layers of regular thin-walled suberised cells alternate with broad layers of loosely arranged radially elongated (slender and filamentous) cells and usually tanniniferous. Phelloderm parenchymatous, weakly developed, crystals occasionally present, sclereids absent or scanty.

Rhytidome weakly developed, 1–2 sheet-like, 0.5–1 mm thick layers observed.

Bark type D (Figs. 5, 11, 14)

Diagnostic characters: Fibres present; phelloderm crystalliferous; rhytidome absent with periderms not formed sequentially.

Material studied: Allocassine laurifolia (Harv.) N.K.B. Robson: Van Wyk 8307, 8397.

General: Phellem with a conspicuous orange pigment. Surface more or less smooth. Inner bark width 1–1.5 mm.

Anatomy: Sieve areas 10–17 per plate. Elements subdivided by 3–4(–5) transverse to oblique anticlinal walls. Companion cells in strands of 1–3 cells. Otherwise similar to bark type A1. Axial phloem parenchyma scanty and inconspicuous.

Phloem rays heterogeneous, uniseriate or sometimes with a short biseriate upright portion. Regular course of rays rapidly disrupted at border between non-collapsed and collapsed phloem.

Fibres already present close to the cambium, single or in irregular groups. Isodiametric small sclereids present in dilated rays adjacent to fibres. Sclereids absent in phelloderm.

Dilatation tissue well developed, as a narrow zone of pseudocortex beneath the periderm; collenchyma groups localised.

Crystals prismatic; confined to rays and dilatation tissue. Smaller prismatic crystals usually present in phelloderm.

Periderm persistent with no sequential periderm formation observed. Phellem exceptionally thick, equalling the inner bark in thickness, composed of thin-walled suberised cells without visible contents. Phelloderm well developed, 5–8 cell layers thick, crystalliferous. Sclereids absent or scanty.

Rhytidome absent, no sequential periderm formation observed.

Bark type E (Figs. 6, 8, 12, 17–19)

Diagnostic characters: Sclereids in continuous bands of densely packed chambered crystalliferous strands; rays composed of predominantly square cells; phelloderm crystalliferous; rhytidome well developed and ramified; *C. tetragona* is peculiar in its liana stem structure with deeply penetrating wedge-shaped secondary phloem inclusions in the wood (Archer 1990).

Material studied: Cassine reticulata (Eckl. & Zeyh.) Codd: Archer 313, Van der Walt s.n. (previously included in *Lauridia* Eckl. & Zeyh.). – *C. tetragona* (L. f.) Loes.: Archer 273, Van Wyk 8276. – *Maurocenia frangularia* (L.) Mill.: Archer 259, 261, Van Wyk A1066.

General: Bark flaky and rough, cracked in a grid-like pattern, continuously exfoliating in small pieces owing to weathering. Newly exposed areas of bark with a yellow pigment in *C. reticulata* and *M. frangularia* (observed only on root bark of *C. tetragona*). Slash pinkish, with a narrow greenish zone just beneath the innermost periderm. Inner bark 1–2 mm wide.

Anatomy: Sieve areas 9–22 per plate. Elements with 3–7 oblique to very oblique anticlinal walls, and usually two or three relatively short companion cells. Axial phloem parenchyma scanty to absent.

Phloem rays heterogeneous, uniseriate or biseriate; composed predominantly of square cells, with short uniseriate margins. Course of rays more or less straight (irregular with a sharp transition between collapsed phloem and pseudocortex in *C. tetragona*).

Sclereids in irregular to well defined tangential or concentric bands in collapsed phloem. The bands composed of densely packed lignified chambered crystalliferous strands. A single prismatic crystal present in each chamber. These bands interrupted only by rays. Sclereids absent in phelloderm.

Dilatation tissue present as narrow zone (pseudocortex) beneath the last-formed periderm. Collenchyma groups occasionally present.

Crystals prismatic; long parenchymatous or sclerified axial chambered crystalliferous strands present in the phloem. Single crystals or crystalliferous strands particularly abundant in *M. frangularia*. Phelloderm well developed, crystalliferous.

Periderm usually represented by (2–)5–8 sequential periderms, formed as discontinuous layers connected to the older layers and usually overlapping, completely separating living tissues from dead. Phellem stratified, composed of 2–4(–5) weakly defined layers of thin-walled suberised cells alternating with 2–5 layers of slightly lignified cells with weakly developed U-shaped thickenings. Phelloderm well developed and crystalliferous. Sclereids absent.

Rhytidome well developed, with (2–)4–8 (only 2–3 in *C. tetragona*) sheet-like layers, each c. 0.2 mm thick; formed by a network of periderms, each new periderm taking a shallow course, thereby producing a thin rhytidome layer.

Discussion

General

Sloughing off and surface patterns of bark were similar in all the samples of *Cassine* s.l. studied. In photographs taken of stems of species of *Cassine*, no constant or conspicuous differences were noticed except in *Allocassine*. Stems of *A. laurifolia* lack a rhytidome and are covered by a thick layer of orange-green phellem which makes it possible to distinguish this bark from all the other samples investigated.

Orange pigments are present in most of the species, and are deposited in the phellem. Rhytidome layers separate from each other by the splitting of the phellem tissue, thus displaying pigments in the freshly exposed phellem surfaces. The bright orange pigment in the bark of various species of *Cassine* s.l. has often been used as a diagnostic field character in general identification guides and keys (Palmer & Pitman 1973; Coates Palgrave 1983). Presence of pigment is also reflected in some of the common names for the group: Bastard saffronwood (*C. peragua*), Common saffronwood (*C. papillosa*), Red saffronwood (*C. crocea*) (Coates Palgrave 1983). Pigment abundance varies considerably between different individuals and populations of a species, and is also affected by the degree of weathering. Orange pigment is very conspicuous in forest trees of *C. papillosa* and *C. peragua* owing to faster sloughing off of the rhytidome layers. In most species of Celastraceae (including Hippocrateaceae) variable amounts of orange pigment may be present in different parts of a plant, e.g. twigs, stems or root (Schlechter & Haller 1942; Krishnamoorthi et al. 1962; Johnson et al. 1963; Hegnauer 1964; unpublished observations). Hegnauer (1964) reported the presence of pristimerin and celastrol, two yellow pigments, in the bark of various species of Celastraceae. The presence of these pigments appears to be diagnostic at the family level.

The slash of all the investigated species varies from red to pinkish or light brown, and no significant interspecific differences were noticed. If the periderm is scraped to expose the outer edge of the phloem, a greenish zone of tissue is usually revealed. The green pigment (chlorophyll) is located in the phelloderm and dilatation tissue.

The presence of elastic threads in species with bark type B, revealed by breaking part of the leaf, stem or bark, is often used as a diagnostic field character for the identification of *C. eucleiformis* (Coates Palgrave 1983). The threads consist of trans-1,4-polyisoprene and are produced in laticifer-like cells ('latex tubes') or possibly in sieve elements (Drennan et al. 1987). There is no cytoplasm visible within these rubber-containing tubes, indicating an atypical laticifer ultrastructure. The presence of elastic threads has been reported in many members of the Celastraceae and Hippocrateaceae in other parts of the world (Blakelock 1951; Hou 1962; Hall & Lock 1975). Elsewhere in the Celastraceae laticifer-like tubes are confined to stem and bark in species of *Euonymus*, while in species of *Wimmeria* the tubes also occur in the leaf (Solereder 1908). No detailed studies have been made on the structure of these tubes in the Celastraceae. They are not explored in this study, but require closer examination.

Total bark width was strongly influenced by the rate of rhytidome sloughing. The width of inner bark (in the sense of Whitmore 1962a, b) only was considered. Bark types C, D and E are characterised by a relatively thin (1.5–3 mm) inner bark. Roth (1981) considered the occurrence of a thin bark (1–3 mm) as rare amongst tropical species. Bark types A1, A2 and B are characterised by an inner bark wider than 5 mm.

Sieve elements

The relatively thick bark sections used in this study were not entirely suitable for the examination of sieve elements. It is, nevertheless, clear that the morphology of these elements conforms to the published information on celastraceous phloem (Zahur 1959, in Appendix).

The sieve elements (type II in Zahur 1959), discernible in the non-collapsed phloem, are more or less similar in the different bark types. The only conspicuous difference is in the number of sieve areas per plate. Zahur (1959) was the first to report the widespread occurrence of secondary septation of phloem elements in the dicotyledons, including Celastraceae. Esau (1969) interpreted these as anticlinal divisions, but later (Esau 1979) designated them secondary partitions. These anticlinal divisions are usually present in the sieve elements of all species investigated.

Companion cells were observed to usually be short strands of (1–)2–4(–5) cells, adjacent to the sieve tube elements. They are small and difficult to recognise in thick sections.

Axial phloem parenchyma

Phloem parenchyma cells are usually scanty. These cells were difficult to discern in the relatively thick sections used, and it is not possible to detail their structure.

Phloem rays

Ray structure is heterogeneous, either uniseriate or multiseriate, with the procumbent portion up to seven cells wide. Uniseriate margins of multiseriate rays are composed of (1–)2–5(–7) mostly upright cells. Bark type E has usually uniseriate rays composed of predominantly square cells, distinguishing it from the other types. The usefulness of this character is limited by difficulty in interpreting ray cell shape in bark sections. More data are needed to establish the taxonomic significance of this feature in the Celastraceae. The rays are composed of thin-walled, non-lignified (at least initially) cells which are usually tanniniferous and/or often crystalliferous. In the dilatation tissue ray cells, traversing groups of sclerenchymatous elements may sometimes become sclerosed (bark types C, D, and E). In the dilatation zone, rays dilate by cell division and tangential cell extension owing to tangential stretching stresses.

With the exception of slight variation in the width, course and dilation of the rays, no constant interspecific differences in ray morphology were noticed.

Sclerenchymatous elements

Mechanical tissue in the form of sclerenchymatous elements is usually the taxonomically most significant pattern-producing tissue in the bark (Chattaway 1953; Roth 1981). Although the sclerenchymatous elements may vary considerably in size, form and distribution in different samples of the same species, they can be used extensively for the delimitation of the various bark types in the investigated material.

No absolute criteria are known to separate sclereids from fibres (Esau 1969). According to the definitions of Parameswaran (1980), it is nevertheless possible to distinguish between fibres, fibre-sclereids, sclereids and lignified parenchyma cells in the investigated celastraceous bark samples.

Fibres are present in bark types C and D. In transverse section, a fibre is recognised as a circular, or tangentially flattened cell with a small lumen. The cell wall is thick, lignified and not polylamellate. Pit size varies from minute to small, c. 3 µm in diameter. The fibres are randomly scattered as single cells, arranged in irregular groups or in thin, weakly developed tangential bands.

Fibre-sclereids are restricted to bark type A1. They develop in or close to the non-collapsed phloem. These elements do not comply with the definitions of either fibres or sclereids and are intermediate between the two. Fibre-sclereids have polylamellate walls and are radially elongate with blunt ends.

Alternating concentric bands of densely packed chambered crystalliferous strands of sclereids with a solitary prismatic crystal in each chamber were found in bark type E. It is not clear from this study whether this type of sclereid develops from the subdivision of a long initial cell or through division of an isodiametric parenchyma cell (Bailey 1961; Parameswaran & Richter 1984). For example, Bailey (1961) described how a sclereid initial becomes compartmentalised by septa and differentiates into a chambered sclereid initial cell. Some of these new sclereid initials repeat the process to produce a strand of sclereids. Ontogenetic studies are needed to clarify the origin of the observed chambered crystalliferous strands of sclereids in Celastraceae. Tangential bands of similar axially elongated chambered crystalliferous strands were also observed in two species of *Catha* Forsk. ex Scop. (unpublished results).

Sclereids were usually recorded in all the examined species of *Allocassine, Cassine, Hartogiella* and *Maurocenia*. A distinction was made between primary and secondary brachysclereids on the basis of their origin. Primary sclereids are present in the non-collapsed secondary phloem, close to the vascular cambium or early in the collapsed phloem, and are characteristic of bark types A1 and A2. In transverse sections of bark these sclereids are scattered as large solitary cells, or clustered in irregular, round or square superposed groups. A weakly defined tangential layering of parenchymatous and sclerenchymatous zones was seen in most samples of bark types A1 and A2. The sclerenchymatous zones occasionally become a continuous ring of sclereids interrupted only by rays.

Secondary sclereids usually arise late in the collapsed phloem and in the dilatation tissue. These sclereids develop from parenchyma cells and are usually characterised by a relatively large size, and polylamellate lignified cell walls. Numerous simple (often branched or ramified) pits and a distinct cell lumen are present. These sclereids vary in number, size and shape and are irregularly dispersed as single cells or groups of sclereids. Cell enlargement usually takes place in a tangential direction owing to tangential stretching in the dilatation tissue. Secondary sclereids were found in most of the samples studied and seem to possess no taxonomic value.

Lignified ray parenchyma cells are sporadic in the dilating rays, collapsed phloem and dilatation tissue of bark types C, D and E. These cells develop from ray parenchyma cells which are in contact with sclerenchymatous elements. They are usually tanniniferous and sometimes tangentially elongated.

Dilatation tissue

This tissue is usually present as the result of ray cell enlargement and multiplication. Dilatation tissue is present as a widening of rays or as a broad continuous band of parenchymatous cells beneath the last-formed periderm. This zone corresponds to the pseudocortex of Whitmore (1962a, b), Roth (1981) and Van Wyk (1985). Large secondary sclereids, occurring singly or in irregular groups, are usually present. Tangential expansion of parenchyma cells and sclereids were frequently observed. Prismatic crystals are abundant in the dilatation tissue, either randomly scattered or in a tangential arrangement.

Calcium oxalate crystals

Calcium oxalate crystals are a very common feature of the secondary phloem (Zahur 1959; Esau 1969; Roth 1981). In fact, crystals are so common in bark that they are usually not taken into account in bark anatomical studies. However, two types of crystals, prisms and styloids, were observed in the bark of the investigated species.

Prismatic crystals are scattered in the bark, with a tendency to be much more abundant in ray cells and phelloderm in certain bark types. They frequently develop in parenchyma cells contiguous with sclereids and within sclereids. Strands of chambered crystalliferous sclereids are present in *Cassine reticulata, C. tetragona* and *Maurocenia frangularia* (bark type E). Crystals and crystalliferous sclereids are particularly abundant in *C. reticulata* and *M. frangularia* (Figs. 17–19).

Styloid crystals are common in the functional phloem of *Cassine eucleiformis* and *C. maritima* (bark type B), where they are found in the axial parenchyma cells and in the uniseriate marginal cells of rays. The presence of styloids is taxonomically important because this crystal type occurs infrequently in bark. For example, Roth (1981) reported styloids in bark of only a few species of two of the 48 families she investigated. Baas (1975) reported styloids in the bark of *Sphenostemon* Baill. (Aquifoliaceae) and used their presence as an important character in the discussion of possible taxonomic affinities of the genus. Styloids are also present in the bark of some of the thornless southern African species of *Maytenus* Molina and in *Pseudosalacia streyi* Codd (unpublished results). Hence, the presence of styloids remains a distinctive taxonomic feature to be taken into account in future bark anatomical work on other celastraceous taxa.

Periderm

Periderm structure is often neglected in bark anatomical studies. Features found to be taxonomically useful in the present study include the presence of a homogeneous or stratified phellem and a sclerified phelloderm. The stratified phellem consists of cells with U-shaped thickened cell walls alternating with layers of thin-walled cells, which may be tanniniferous or empty. Layers of thin-walled, radially elongated cells also contribute to the stratification of the phellem.

The stratified phellem with lignified or elongated cell layers (as in *Cassine barbara, C. peragua* and *C. parvifolia*) is useful for the recognition of bark type C. According to Roth (1981), lignification of cork cells is probably more effective than suberisation in a humid tropical forest environment, since it gives better protection to the bark against fungal and bacterial attack. The southern African species with bark type C (especially *C. peragua*) are often associated with forests or humid environments.

The presence of a weakly sclerified phelloderm in bark type A1 is considered taxonomically important, although its degree of development may show considerable variation. Nevertheless, it is one of the main diagnostic characters of this bark type, distinguishing it from the very similar type A2. More bark samples of Celastraceae need to be studied to fully evaluate the taxonomic significance of this tissue. The crystalliferous phelloderm, often present in bark types A, D and E, is very distinctive and allows them to be distinguished from the other types.

Rhytidome

A well-developed rhytidome occurs in bark types A1, A2 and E. In bark type E the secondary phloem/rhytidome ratio is 1:1. The bark of many species in forest environments is frequently covered with epiphytic mosses and lichens. The absence of a conspicuous rhytidome in many of the samples could perhaps be ascribed to weathering conditions. Bark type D (*Allocassine*) is distinct in always having only one periderm accompanied by a thick and conspicuous phellem.

Taxonomic conclusions

Although studies of bark anatomy have not been carried out on a wide enough scale to fully evaluate the taxonomic significance of the observed diversity in bark structure, our observations are extremely useful for the subdivision of the southern African fleshy-fruited Celastraceae. The diversity in bark structure encountered in the study provides significant support for the recognition of a number of small segregate genera as proposed by some authors, e.g. Loesener (1894, 1942) and Robson (1965). The different bark types show remarkable congruence with the generic delimitation of Loesener (1942) and Robson (1965). Robson (1965, 1966), in his revision of Celastraceae for the Flora Zambesiaca region, recognised five genera in *Cassine* s.l., namely *Cassine* s.str., *Elaeodendron, Mystroxylon, Crocoxylon,* and *Allocassine. Lauridia* was included in *Elaeodendron* on account of some shared macromorphological characters. Of the aforementioned genera, only *Allocassine* (p.p.), *Cassine* s.l., *Maurocenia* and *Hartogiella* have been upheld in recent years (Codd 1966; Gibbs Russell et al. 1987). All sources of evidence investigated (Archer 1990; Archer & Van Wyk 1992; Den Hartog-Van Ter Tholen & Baas 1978) provide unequivocal taxonomic criteria for distinguishing between a number of genera.

The species with bark type A1 fall within the concept of the genera *Elaeodendron* and *Crocoxylon*. An extra-African species of *Elaeodendron* (*E. quadrangulata*) also displays this bark type (unpublished results). The species with bark type A1 can usually be told apart by slight variations. It is, however, not possible to consistently distinguish between the closely related *Elaeodendron* and *Crocoxylon* on the basis of this variation. The well-delimited genus *Crocoxylon* can, however, be distinguished from *Elaeodendron* by its pollen structure and peculiar floral characters (Archer 1990; Archer & Van Wyk 1992). Examination of more bark of African and also the Asiatic species of *Cassine* s.l. will be necessary to fully assess the taxonomic status of *Elaeodendron* and *Crocoxylon*.

Species formerly placed in *Mystroxylon* display two distinct types of bark; A2 and B. These conform to a previous subdivision of the species in *Mystroxylon* (Loesener 1942). The species with bark type A2 correspond to the species in the section *Eumystroxylon* Loes. and are characterised by large secondary sclereids. *Mystroxylon*, as defined by Archer (1990), is distinguished by constantly alternate leaves, pubescence and several anatomical features.

Species with bark type B conform to Loesener's *Mystroxylon* sect. *Pseudoscytophyllum* (Loesener 1942). These species are unique in possessing styloid crystals and elastic threads, and in lacking primary sclerenchymatous elements. *Cassine eucleiformis* can usually be distinguished from *C. maritima* by the presence of small secondary sclereids in the dilatation tissue. A new genus, which still requires formal description, is proposed for these two species (Archer 1990; Archer & Van Wyk 1992).

Cassine, as defined in a narrow sense by Robson (1965), comprises two southern African species only, namely *C. peragua* (nomenclatural type) and *C. parvifolia*. Robson considered *C. barbara* to be congruent with *C. peragua*. Furthermore, Codd (1966) has expressed doubts as to the generic status of *Hartogiella* (= *Hartogia* Thunb. ex L. f. non L.), a genus hitherto considered to be distinct on the basis of seed characters. However, *H. schinoides* is characterised by bark type C, a character shared with *C. barbara, C. peragua* and *C. parvifolia*. The overall morphological and anatomical similarity of the species with bark type C supports their inclusion under *Cassine* s. str. (Archer 1990). Since *C. peragua* is the nomenclatural type of the genus *Cassine*, this step will necessitate name changes for at least some, if not all, species of *Cassine* s. l. from other parts of the world.

Robson (1965) first described *Allocassine* to accommodate the species *A. laurifolia* and *A. tetragona* (L. f.) N.K.B. Robson. *Allocassine* is upheld by Codd (1966) and Gibbs Russell et al. (1987) as a monotypic genus, including only *A. laurifolia*. The above-mentioned authors prefer to treat *A. tetragona* as a species of *Cassine* s. l. The marked distinction in bark structure between these two species supports their view. *Allocassine laurifolia* differs from all the other investigated species by the absence of a rhytidome. *Cassine tetragona* occupies a fairly isolated position but shares bark type E with *C. reticulata* and *Maurocenia frangularia*. On the basis of general anatomy and aspects of macromorphology, the two last-mentioned species are clearly very similar, and are separated from each other only by the mode of attachment of ovules (Archer 1990).

This study has clearly shown that bark anatomical features are extremely useful for elucidating taxonomic relationships between the southern African species of *Cassine* s. l. Further studies of the bark anatomy of members of the Celastraceae, and in particular species of *Cassine* s. l. from other parts of the world, are essential to clarify the infrafamilial taxonomy of the family.

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APPENDIX 8

WOOD STRUCTURE AND GENERIC STATUS OF SOME SOUTHERN AFRICAN CASSINOIDEAE (CELASTRACEAE)[*]

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WOOD STRUCTURE AND GENERIC STATUS OF SOME SOUTHERN AFRICAN CASSINOIDEAE (CELASTRACEAE)

by

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Summary

Opinions differ on whether to treat *Cassine* in southern Africa in a wide sense, or to recognise several segregate genera, such as *Elaeodendron, Crocoxylon, Lauridia, Mystroxylon* and *Cassine* s. str. A comparative anatomical study was made of mature wood representing 17 southern African species of *Cassine* s.l., *Pleurostylia* and the three monotypic genera, *Allocassine, Hartogiella* and *Maurocenia* (all members of the subfamily Cassinoideae). The wood structure is described with emphasis on the taxonomic value of quantitative and qualitative characters. Various features were found to be diagnostic at supraspecific level. The presence or absence of scalariform perforation plates, septate fibres, various ray types, and additional quantitative characters could be useful for taxonomic application, especially for generic delimitation. Three principal wood types, of which one encompasses three subtypes, are recognised among the species examined. Wood anatomical evidence tells against a wide generic concept for *Cassine*, and favours the recognition of segregate genera.

Key words: Systematic wood anatomy, taxonomy, Cassine s.l., Cassinoideae, Celastraceae.

Introduction

This study forms part of a multidisciplinary approach to a taxonomic revision of the southern African members of the subfamily Cassinoideae (Archer 1990; Archer & Van Wyk 1992, 1993). Established by Loesener (1892), this subfamily accommodates the species of Celastraceae with indehiscent fruits, usually drupes or berries.

On a world-wide basis, *Cassine* is sometimes treated in a very broad sense to include *Elaeodendron* and a number of smaller genera comprising mainly southern African species with indehiscent and usually fleshy fruits (amongst others Kuntze 1891; Loesener 1892; Davison 1927; Hou 1962; Codd 1966). This treatment of *Cassine* s.l. has received wide support. However, the concept of an inclusive *Cassine* s.l. could well be artificial as authors, such as Loesener (1942; contrary to his 1892 treatment) and Robson (1965, 1966), subdivided the fleshy fruited southern African Celastraceae into a number of segregate genera, for example *Allocassine, Cassine* s. str., *Crocoxylon, Elaeodendron, Lauridia* and *Mystroxylon*. It is suggested that multidisciplinary research may lead to an improved understanding of the generic limits of not only *Cassine*, but also the rest of the family.

The wood structure of several species of Celastraceae was described in varying detail by authors such as Moll & Janssonius (1908), Solereder (1908), Loesener (1892, 1894, 1942), Pearson & Brown (1932), Record (1938), Desch (1941, 1954), Record & Hess (1943), Metcalfe & Chalk (1950), Tortorelli (1956), Ingle & Dadswell (1961), Mennega (1972), Kromhout (1975, 1977), Miles (1978), Ilic (1987), Carlquist (1988a) and Zhang Xinying et al. (1990). Of these contributions, those of Record (1938) and Record & Hess (1943) are the most elaborate and contain wood anatomical descriptions for 16

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celastraceous genera including *Cassine* s.l. Metcalfe and Chalk (1950) comprehensively summarised the older literature. More recent publications on the wood anatomy of Celastraceae s.str. are scanty and fragmentary (Gregory 1980).

Except for the contributions by Kromhout (1975, 1977) and Dyer (1988), which contain information on wood of some celastraceous species, and the summarised data in Metcalfe & Chalk (1950), very little work has been done on the comparative wood structure of the southern African species of *Cassine* s.l. The lack of commercially important timber species in the region may be one of the reasons for the paucity of comparative wood anatomical studies on the group.

For a better understanding of the taxonomy of *Cassine*, extensive taxonomic evidence from a variety of sources is required. In this study the taxonomic significance of wood anatomical characters of the southern African species of *Cassine* s.l. and the three monotypic genera, *Hartogiella, Maurocenia* and *Allocassine*, was studied. Our emphasis has been mainly placed on those differentiating characters that might be employed taxonomically on the supraspecific level. Although also placed under the Cassinoideae by Loesener (1892, 1942), *Pleurostylia*, with its dry fruits, is not considered to be closely related to the other southern African Cassinoideae. It has nevertheless been included in the present study for comparative purposes.

Materials and Methods

Fifty-five samples of wood representing 17 southern African species of *Allocassine, Cassine, Hartogiella, Maurocenia* and *Pleurostylia* were studied using mainly light microscopy (LM), and to a lesser extent, scanning electron microscopy (SEM). Species names and their author citations are supplied in Table 1. Voucher specimens and slides are housed in the H.G.W.J. Schweickerdt Herbarium (PRU) and are listed under Results. Codes from Stern's Index Xylariorum (1988) indicate the sources of other samples.

Wood samples were collected with an increment borer from upright stems at about 1 m height. Samples of *A. laurifolia* (liana), *C. parvifolia* (shrub or small tree), *C. reticulata* (shrub or small tree) and *C. tetragona* (liana) were collected from stems, measuring 30–80 mm in diameter, whereas the stem diameter in all the other taxa exceeded 100 mm. Samples were fixed in FAA (Johansen 1940). Wood of *C. schlechteriana* (under which some workers have included *C. stuhlmannii*) was not available for comparative study.

Standard procedures for wood anatomy were used to prepare transverse, radial and tangential sections, macerations and blocks for SEM observations (Van Wyk et al. 1983). Measurements of wood anatomical features were made with a personal computer equipped with a graphics tablet in combination with a projection LM. Means, standard deviation, minimum and maximum values are based on at least sixty individual measurements. Septate libriform fibres were not clearly discernable in macerations and have therefore not been measured in these preparations. Crude estimates of the length of the latter elements were made on longitudinal sections. Descriptive terminology follows Carlquist (1988b) and the recommendations of the International Association of Wood Anatomists (IAWA Committee 1989).

Results and Discussion

Anatomically three wood types are distinguishable and described below. Qualitative and quantitative data are summarised in Tables 2 and 3. Alternative generic treatments of taxa are mentioned in Table 1.

Wood type A (Figs. 1, 9, 15; Table 2)

Diagnostic characters: Vessel elements with scalariform perforation plates; septate libriform fibres in apotracheal banded arrangement between fibre-tracheids; without axial parenchyma.

Material studied: Cassine crocea: Archer 303, 366, Briers s.n. – *C. matabelicum:* Venter & Archer 184, 185, Venter, Archer & Hahn 408. – *C. papillosa:* Archer 263, 283, 325, 344, 446, PFPw X787, Van Greuning 626. – *C. transvaalensis:* Archer 245, 246, 325, Pienaar & Archer 1338.

Growth rings absent or weakly defined owing to the presence of slightly denser zones

Table 1. Summary of different taxonomic treatments of southern African Cassinoideae, and a proposed new generic classification.

Species of southern African Cassinoideae; *Cassine* treated in a wide sense[1]	Alternative generic treatment[2]	Wood type	Proposed new generic treatment[3]
Cassine crocea (Thunb.) Kuntze	*Crocoxylon* Eckl. & Zeyh.	A	*Crocoxylon* Eckl. & Zeyh.
C. transvaalensis (Burtt Davy) Codd			
C. matabelicum (Loes.) Steedman	*Elaeodendron* Jacq. f.		
C. papillosa (Hochst.) Kuntze[4]			*Elaeodendron* Jacq. f.
C. barbara L.	*Cassine* L. s. str.	B1	*Cassine* L. s. str.
C. parvifolia Sond.			
C. peragua L.			
Hartogiella schinoides (Spreng.) Codd	*Hartogiella* Codd		*Hartogiella* ?
Maurocenia frangularia (L.) Mill.	*Maurocenia* Mill.	B2	*Maurocenia* Mill.
Cassine tetragona (L. f.) Loes.	*Allocassine* N.K.B. Robson		*Lauridia* Eckl. & Zeyh.
C. reticulata (Eckl. & Zeyh.) Codd	*Lauridia* Eckl. & Zeyh.		
Allocassine laurifolia (Harv.) N.K.B. Robson	*Allocassine* N.K.B. Robson	B3	*Allocassine* N.K.B. Robson
Cassine aethiopica Thunb.	*Mystroxylon* Eckl. & Zeyh. sect. *Eumystroxylon* Loes.	C	*Mystroxylon* Eckl. & Zeyh.
C. burkeana (Sond.) Kuntze			
C. eucleiformis (Eckl. & Zeyh.) Kuntze	*Mystroxylon* Eckl. & Zeyh. sect. *Pseudoscytophyllum* Loes.		Genus nov. A
C. maritima (H. Bol.) L. Bol.			
Pleurostylia capensis (Turcz.) Loes.[5]	*Pleurostylia* Wight & Arn.		*Pleurostylia* Wight & Arn.

1) E.g., Davison 1927; Codd 1966, 1983; Gibbs Russell et al. 1987; Arnold & De Wet 1993.

2) E.g., Loesener 1942; Robson 1965, 1966.

3) Archer 1990; Archer & Van Wyk 1992, 1993.

4) Incorrectly referred to as *Cassine crocea, Elaeodendron croceum* or *Crocoxylon croceum* by many authors. The identity of existing wood samples or slides carrying the epithet '*croceum*' should be considered suspect, and is most likely to be *Cassine papillosa*.

5) With its dry fruit, *Pleurostylia* does not appear to be closely related to the other southern African Cassinoideae.

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of fibres. Wood diffuse-porous, rarely appearing semi-ring-porous.

Pores predominantly solitary or rarely in small radial multiples, numerous, (78–)104–139(–188)/mm², round to oval or slightly angular, tangential diameter 30–40 (11–61) µm, walls 5–8 µm thick.

Vessel elements with short to long tails, length (including tails) 488–749 (130–1250) µm. Perforation plates exclusively scalariform and oblique with less than ten bars, but 10–18 in *C. papillosa*, bars sometimes branched. Intervessel pits if present rounded to polygonal, alternate, often coalescent, 4–8 µm in

Table 2. Summary of selected qualitative and quantitative wood anatomical data on *Allocassine, Cassine* s.l., *Hartogiella, Maurocenia* and *Pleurostylia* (+ = present; – = absent).

Material	Vessels with scalariform perforation plates	Number of bars in perforation plate	Septate fibres present	Axial parenchyma present	Kribs ray type	Ray cell width	Body ray cells	Vessel elements				Fibre-tracheid length	
								Length		Tangential pore diameter			
								$\bar{X}$	Range	$\bar{X}$	Range	$\bar{X}$	Range
Wood type A													
Cassine crocea	+	10	+	–	he-I	2–5	Procumbent	488	(190–950)	29.7	(13.3–52.3)	957	(330–2270)
Cassine matabelicum	+	8	+	–	he-I	2–4	Procumbent	569	(244–903)	39.5	(15–47.1)	1028	(495–2069)
Cassine papillosa	+	18	+	–	he-I (IIA)	2–4	Procumbent	749	(250–1250)	34.7	(10.8–46.1)	1340	(600–2450)
Cassine transvaalensis	+	10	+	–	he-I (IIA)	4–7	Procumbent	555	(130–970)	36.7	(13.1–61.4)	1048	(420–2200)
Wood type B													
Allocassine laurifolia	–	–	+	–	he-III	1	Upright	560	(330–1140)	39.4	(14.0–46.7)	835	(250–1150)
Cassine barbara	–	–	+	–	he-I	3	Procumbent	490	(200–710)	24.9	(20.5–37.7)	690	(380–900)
Cassine parvifolia	–	–	+	–	he-III	1	Square	630	(340–1080)	24.8	(17.7–36.8)	770	(370–1120)
Cassine peragua	–	–	+	–	he-I (IIA)	2–4	Procumbent	556	(200–1010)	31.1	(15.9–53.0)	800	(280–1550)
Cassine reticulata	–	–	+	–	he-III	1	Square	650	(370–900)	21.2	(13.1–32.5)	770	(490–1370)
Cassine tetragona	–	–	+	–	he-III	1	Square	570	(270–1000)	68.0	(42.4–80.8)	815	(440–1550)
Hartogiella schinoides	–	–	+	–	he-I	2	Procumbent	640	(440–970)	31.9	(14.9–44.1)	813	(420–1330)
Maurocenia frangularia	–	–	+	–	he-III	1(–2)	Square	495	(340–950)	29.4	(24.1–47.6)	640	(430–1150)
Wood type C													
Cassine aethiopica	–	–	–	+	he-IIA (I)	4–5	Procumbent	424	(150–740)	32.6	(18.1–46.9)	810	(400–1550)
Cassine burkeana	–	–	–	+	he-IIA	4–5	Procumbent	320	(140–630)	26.4	(15.7–37.7)	700	(300–1230)
Cassine eucleiformis	–	–	–	+	he-IIA (I)	2–5	Procumbent	476	(180–900)	24.9	(14.4–37.3)	723	(270–1153)
Cassine maritima	–	–	–	+	he-IIA (I)	4–5	Procumbent	480	(340–640)	25.5	(17.2–41.3)	655	(430–980)
Pleurostylia capensis	–	–	–	+	he-IIA	3–4	Procumbent	607	(473–936)	34.0	(22.1–37.5)	1002	(650–1614)

diameter. Vessel-ray pits similar to intervascular pitting but half-bordered or with reduced borders. Frequently with amorphous deposits. Tyloses rarely present, thin-walled.

Imperforate tracheary elements consist of two types of cells: thick-walled fibre-tracheids with pits mostly conspicuously bordered, and thin-walled septate libriform fibres. Fibre-tracheids 912–1340 (303–2450) µm long, pits conspicuous, 2–5 µm in diameter, density on radial and tangential walls more or less equal. Cell walls vary from thick to very thick. Fibre-tracheid bands alternating with 4–10 cells wide bands of thin-walled septate libriform fibres closely resembling axial parenchyma, with simple slit-like pits, shorter than fibre-tracheids.

Axial parenchyma rare or absent.

Rays uni- and multiseriate (heterogeneous type I), up to 8 cells wide, 3–60 cells high, heterocellular with procumbent body ray cells, with 1–5 rows of upright marginal cells. Perforated ray cells very rarely noted.

Crystals of calcium oxalate always prismatic, common in ray cells.

Additional features: Usually no visual distinction between heart- and sapwood. Colour of wood pale to dark brown. Froth test positive for species tested (Dyer 1988).

Note: Except for minor quantitative variation, it is not possible to distinguish between the wood structure of the species with this wood type (Table 2).

Wood type B (Figs. 2–6, 10–13, 16–18; Table 2)

Diagnostic characters: Vessel elements with simple perforation plates; septate libriform fibres in apotracheal banded arrangement between fibre tracheids or ordinary non-septate fibres; without axial parenchyma.

Material studied: Cassine barbara: Van Wyk A1138. – *C. parvifolia:* Van Greuning 627. – *C. peragua:* Archer 238, 257, 285, PFPw X879, id. 1552, Van Jaarsveld 10581, 10583. – *C. reticulata:* Archer 311, Van der Walt s.n. – *C. tetragona:* Van Wyk 8276, A1072. – *Allocassine laurifolia:* Van Wyk 8307, 8397. – *Hartogiella schinoides:* Archer 285, Van Jaarsveld 10580, 10582. – *Maurocenia frangularia:* Van Wyk A1066, Zeyher 69 (Uw 20500).

Growth rings absent or weakly defined owing to the presence of slightly denser zones of fibres. Wood diffuse-porous, rarely appearing semi-ring- porous.

Pores predominantly solitary or rarely in small radial multiples, numerous, (65–)85–158(–189)/mm^2, round to oval or slightly angular, tangential diameter 21–68 (14–81) µm (68 µm in *C. tetragona*), walls 4–8 µm thick.

Vessel elements with short to long tails, length 490–650 (200–1140) µm. Perforation plates simple and oblique. Intervessel pits if present rounded to polygonal, alternate, often coalescent, 4–8 µm in diameter. Vessel-ray pits similar to intervascular pitting but half-bordered or with reduced borders. Occasionally with tanniniferous deposits.

Imperforate tracheary elements consist of two types of cells: thick-walled fibre-tracheids with pits mostly conspicuously bordered [inconspicuous in the two lianes *A. laurifolia* and *C. tetragona* (approaching ordinary libriform fibres)], and thin-walled septate libriform fibres. Fibre-tracheids 640–835 (250–1550) µm long, pits conspicuous, 2–5 µm in diameter, density on radial and tangential walls more or less equal. Cell walls vary from thick to very thick. Septate libriform fibres present in concentric bands, 8–12 cells wide, shorter than fibre-tracheids.

Axial parenchyma rare or absent.

Rays 1–3 cells wide, 4–50 cells high, biseriate section not much thicker than uniseriate section, heterocellular with procumbent body ray cells, heterogeneous type IIA, or uniseriate and nearly homocellular (heterogeneous III) with predominantly square (*C. reticulata* and *C. tetragona*) or upright (*A. laurifolia*) cells .

Crystals of calcium oxalate prismatic, common in ray cells.

Additional features: Usually no visual distinction between heart- and sapwood. Colour of wood pale to dark brown. In one species (*C. tetragona*) wedge-shaped radial invaginations of bark result in an irregular outline of the wood cylinder. Froth test positive for species tested (Dyer 1988).

Note: This is a fairly heterogeneous group which varies mainly in ray structure. Wood type B can be subdivided into three subtypes:

Table 3. Summary of selected wood anatomical features of some extra-southern African species of *Cassine* s.l. (including *Elaeodendron*) (+ = present; – = absent).

Taxa	Scalariform perforation plates	Septate fibres	Axial parenchyma	Source
Cassine australis (Vent.) Kuntze	+	+	–	Ilic 1987
C. buchananii Loes.	+	+	–	Loesener 1894
C. curtipetala (Endl.) Kuntze	+	+	–	–
C. glauca (Pers.) Kuntze	+	+	Banded	Moll & Janssonius 1908
C. orientalis (Jacq. f.) Kuntze (Venter et al. 362[1])	+	+	–	–
C. orientalis (U 184721)	±	–	Diffuse	–
C. quadrangulata (Reiss.) Kuntze	–	+	–	–
C. stuhlmannii (Loes.) Blakelock	+	+	–	Loesener 1894, Barefoot & Hankins 1982
C. xylocarpa Vent.[2]	+	+	–	Record 1934, Record & Hess 1943
Elaeodendron afzelii Loes.[2]	+	?	?	Loesener 1894

[1] The identity of one of these samples is, although celastraceous, likely to be wrong.
[2] Information from the literature only.

Subtype B1 (Figs. 2–4, 10, 11, 16): body ray cells procumbent with 2–4 rows of marginal upright cells (*C. barbara, C. peragua* and *H. schinoides*), rays uniseriate with upright to procumbent cells in *C. parvifolia*. Except for *C. parvifolia*, the wood of these species is very similar.

Subtype B2 (Figs. 5, 6, 12, 17): ray cells predominantly square (*C. reticulata*), occasionally with marginal cells slightly upright (*C. tetragona* and *M. frangularia*). The large average pore diameter and deeply penetrating, wedge-shaped, radial secondary phloem inclusions encountered in *C. tetragona* (a liane or scrambling shrub) are very characteristic.

Subtype B3 (Figs. 13, 18): all ray cells conspicuously upright (*A. laurifolia*).

Wood type C (Figs. 7, 8, 14; Table 2)

Diagnostic characters: Vessel elements with simple perforation plates; axial parenchyma abundant, in apotracheal banded arrangement between fibre-tracheids; without septate fibres.

Material examined: C. aethiopica: Archer 244, 247, 286, 327, 379, Schlieben 1515, E. Africa (Uw 15495). – *C. burkeana:* Archer 210, 211. – *C. eucleiformis:* Archer 299, 233, 235, 240, 241, 242, Van Wyk A1048. – *C. maritima:* Archer 277, Van Greuning 628. – *Pleurostylia capensis:* Venter 13624, PFPw X119.

Growth rings absent or weakly defined owing to the presence of slightly denser zones of fibres. Wood diffuse-porous, rarely appearing semi-ring-porous.

Pores predominantly solitary or rarely in small radial multiples, numerous, (73–)96–120(–136)/mm², round to oval or slightly angular, tangential diameter 25–34 (14–47) µm, walls 4–8 µm thick.

Vessel elements with short to long tails, length (including tails) 320–607 (140–936) µm (607 µm in *P. capensis*). Perforation plates simple and oblique. Intervessel pits if present rounded to polygonal, alternate, often coalescent, 4–8 μm in diameter. Vessel-ray pits similar to intervascular pitting but half bordered or with reduced borders. Occasionally with tanniniferous deposits.

Imperforate tracheary elements consist of fibre-tracheids with pits mostly conspicuously bordered, 655–1002 (270–1614) μm (1002 μm in *P. capensis*) long, pits conspicuous, 2–5 μm in diameter, density on radial and tangential walls more or less equal. Cell walls vary from thick to very thick.

Axial parenchyma apotracheal, widely banded. Bands 4–12 cells wide, up to 5 bands per growth ring.

Rays 1–8 cells wide, 5–60 cells high, heterocellular with procumbent body ray cells, heterogeneous type IIA, uniseriate rays short with mostly upright cells, multiseriate rays with a multiseriate portion of procumbent cells and usually with a short uniseriate margin.

Crystals of calcium oxalate prismatic, occasionally in axial parenchyma, common in ray cells.

Additional features: Usually no visual distinction between heart- and sapwood. Colour of wood pale to dark brown. Froth test positive for species tested (Dyer 1988).

Note: This wood type forms a very homogeneous group with little interspecific variation. *Pleurostylia capensis*, however, can be recognised by its much longer vessel elements and fibre-tracheids.

Wood of extra-southern African species of Cassine s.l.

Material studied: Cassine australis: Australia, Uw 18469. – *C. buchananii:* Mennega & Baretta 224, Kenya, Uw 18917. – *C. curtipetala:* New Caledonia, Uw 18470. – *C. glauca:* Jayawardana 52, Ceylon, Uw 18503. – *C. orientalis:* Director of forests, Mauritius (Uw 18472), Lorenze 2547 (MAU), twigwood, Venter, Archer & Hahn 326, Zimbabwe, planted as ornamental trees. – *C. quadrangulata:* Archer & Van Wyk s.n., cult. Durban Botanic Garden (NH). – *C. stuhlmannii:* Schlieben 540, E. Africa, Uw 15631.

Selected wood anatomical features of these taxa are summarised in Table 3. Also included in Table 3 is published data on *Cassine xylocarpa* and *Elaeodendron afzelii*.

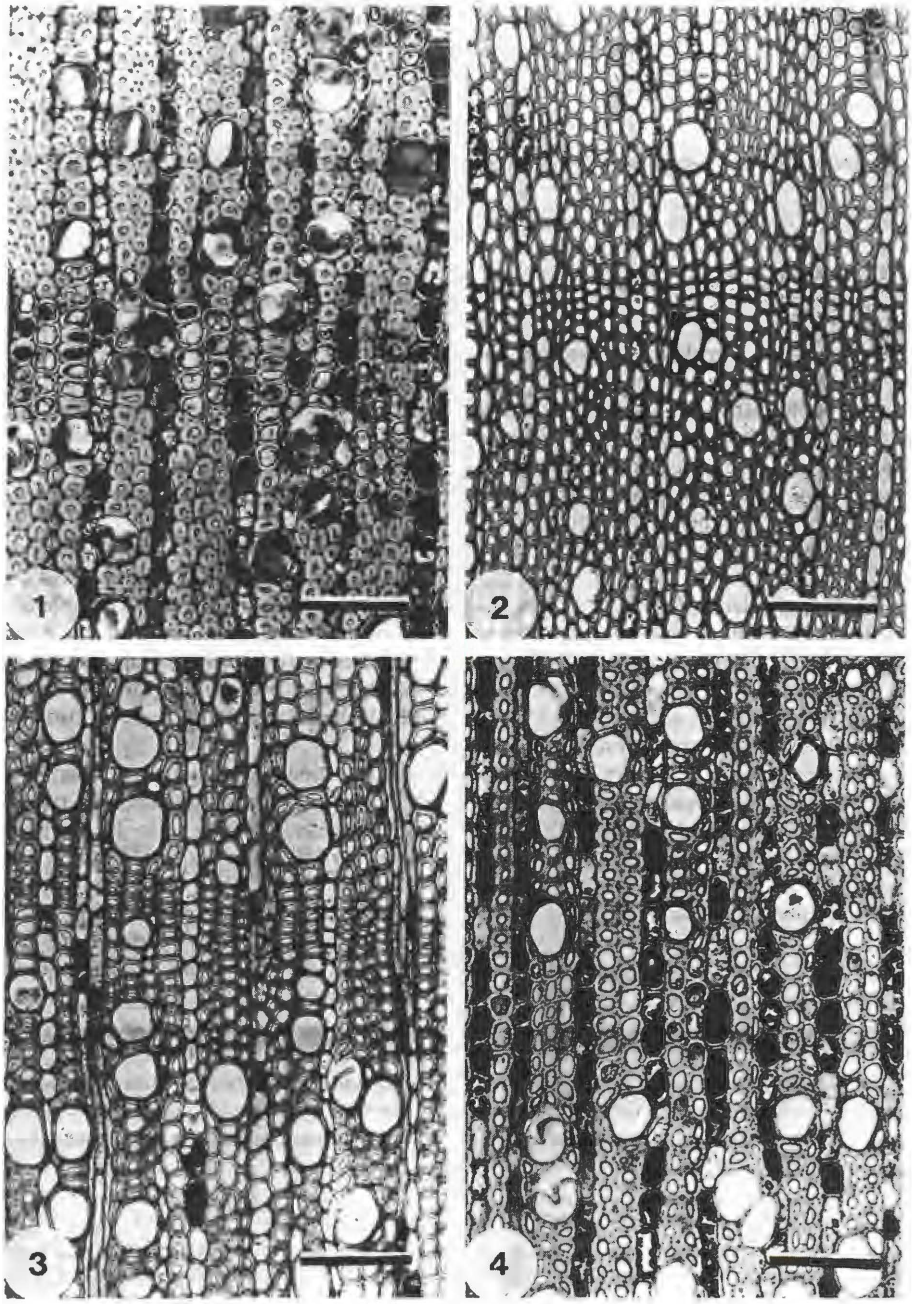
Discussion of selected wood anatomical features

Growth rings and vessels

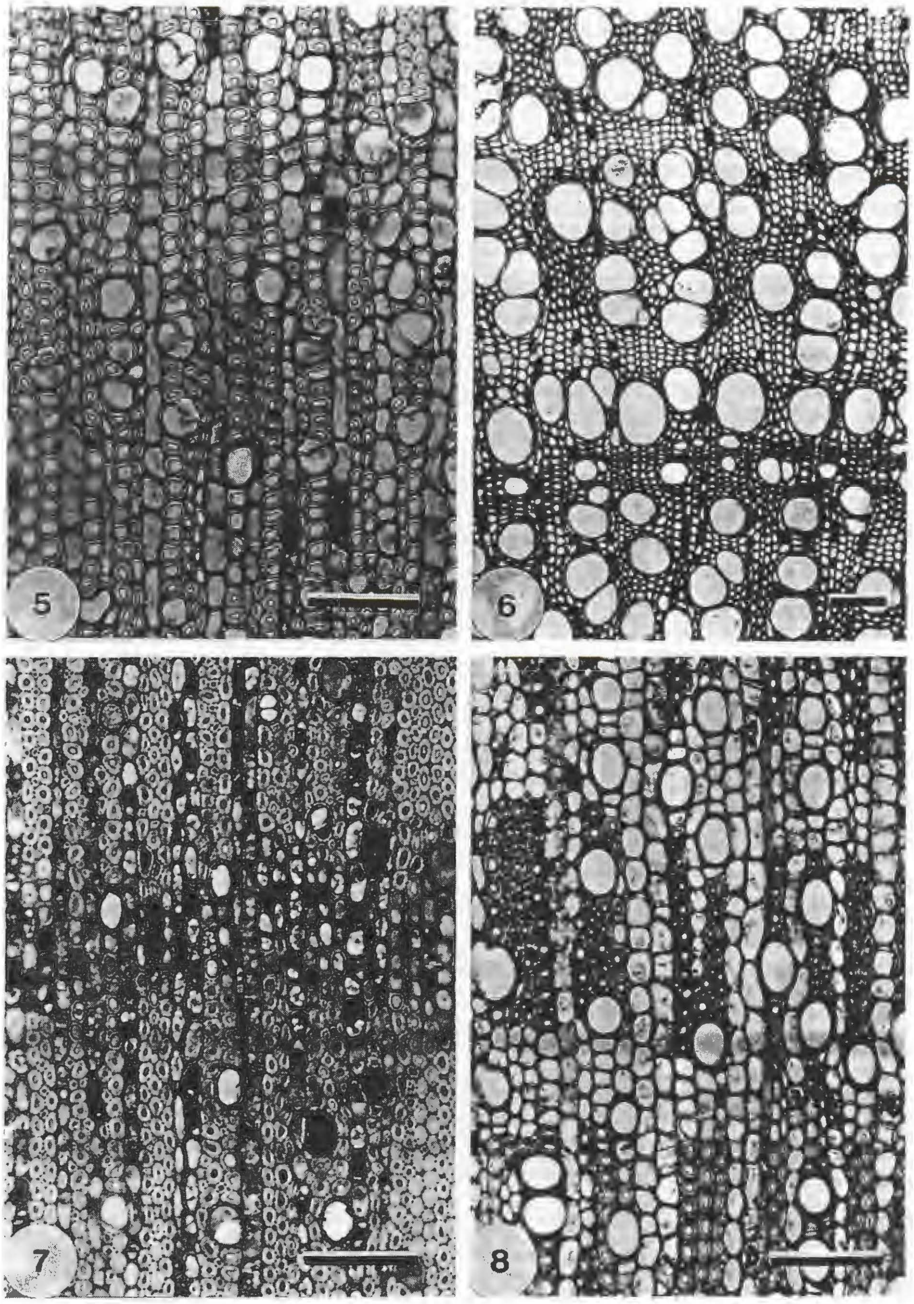
Growth rings are usually faint, but can be distinguished by slightly denser fibre-tracheids in the late wood. Wood is diffuse-porous, although pores may be wider or more numerous in the early wood, thus giving the impression of being semi-ring-porous. Vessels filled with thin-walled tyloses and/or amorphous material have been observed often in samples but have little if any taxonomic significance. The length and tangential diameters of vessel elements are given in Table 1. Vessel-element length weakly correlates with the three wood types distinguished in this study, and can be used to assist in their separation.

Dimensional variation and structure of vessel elements in wood of southern African species of *Cassine* agree with available data on other Celastraceae of southern Africa (Kromhout 1975, 1977; unpublished results) and the rest of the world (Moll & Janssonius 1908; Record 1938; Ingle & Dadswell 1961).

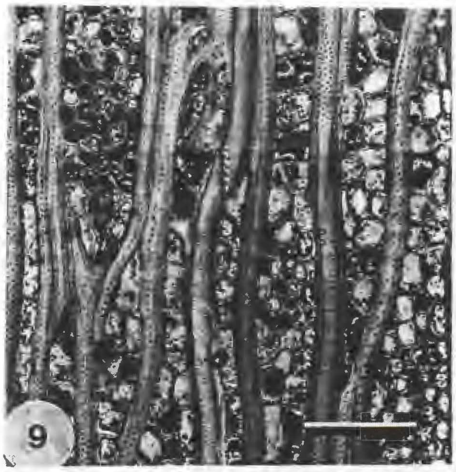
Perforation plates with 4 to 18 bars were found in only four species of wood type A. In this study, as well as in the literature (Loesener 1894), the wood of *C. stuhlmannii*, which Robson (1966) considered synonymous with *C. schlechteriana*, has also been observed with scalariform perforation plates. The work of Frost (1930) amongst others, has shown the type of perforation plate to be a good taxonomic character not easily modified by environmental variation. The wood of American and Javanese species of *Elaeodendron* is characterised by the presence of vessels with scalariform perforation plates (Moll & Janssonius 1908; Record 1938). The lack of scalariform perforation plates has been considered characteristic of all other celastraceous genera with indehiscent fruit (Loesener 1892, 1942; Record 1938; Record & Hess 1943). Scalariform perforations have been used by workers such as Loesener (1942), Hartog-Van Ter Tholen & Baas (1978) and Mennega (pers. comm.) to justify *Elaeodendron* as a taxon distinct from *Cassine* and *Mystroxylon*.



Figs. 1–4. TS – 1: *Cassine papillosa* (Van Greuning 626), wood diffuse-porous with bands of thin-walled septate fibres. – 2: *C. parvifolia* (Van Greuning 627) & 3: *C. peragua* (Archer 257), wood diffuse-porous with weakly defined ring boundary. – 4: *Hartogiella schinoides* (Van Jaarsveld 10580), wood diffuse-porous with bands of thin-walled septate fibres. – Scale bars: 100 µm.



Figs. 5–8. TS – 5: *Maurocenia frangularia* (Van Wyk A1066), wood diffuse-porous. – 6: *Cassine tetragona* (Van Wyk A1071), with wide vessels. – 7: *C. eucleiformis* (Archer 240), wood diffuse-porous with bands of axial parenchyma. – 8: *C. aethiopica* (Archer 244), wood diffuse-porous with bands of axial parenchyma. – Scale bar = 100 µm.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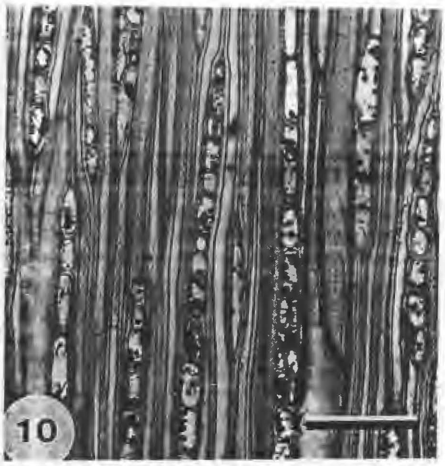
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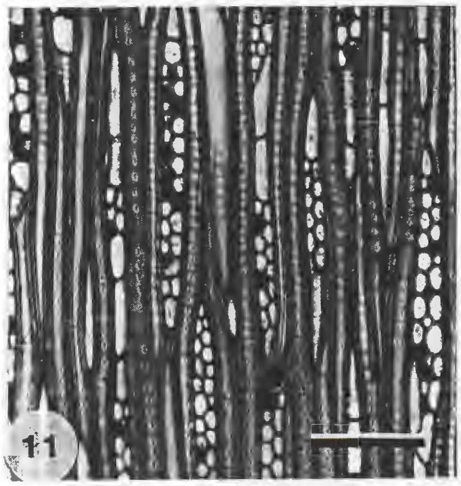
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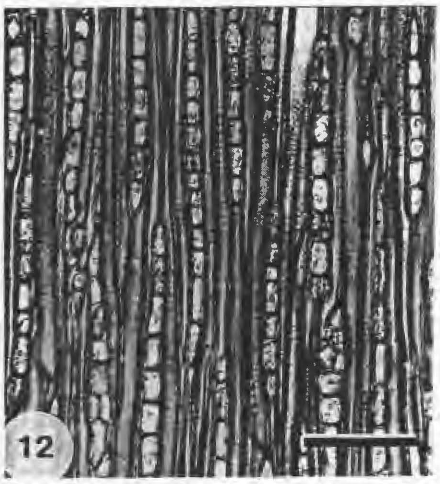
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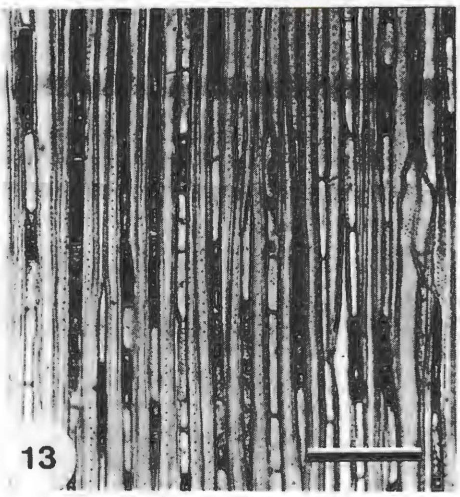
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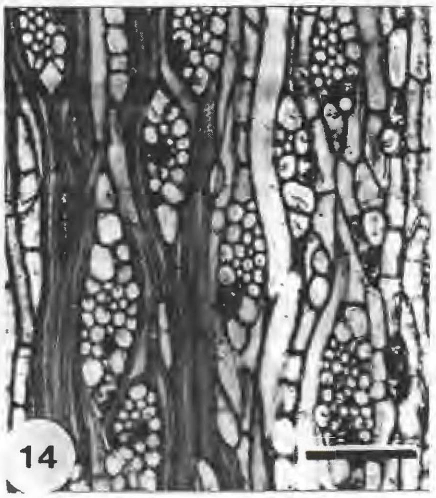
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In the literature, the following non-southern African species of *Cassine* s.l. (= *Elaeodendron*) are described as characteristically possessing scalariform perforation plates: *E. afzelii* (Loesener 1894); *C. glauca* with 1–4 bars (Moll & Janssonius 1908) or with simple and scalariform plates mixed (Solereder 1908); and *C.xylocarpa* (Record 1938; Record & Hess 1943). The only other celastraceous taxa known to have scalariform perforation plates are *Goupia* (Record 1938; Record & Hess 1943), *Bhesa* (previously named *Kurrimia*) (Solereder 1908; Zhang Xinying et al. 1990), *Perrottetia* (Versteegh 1968; DeBuhr 1978), and *Empleuridium* with both simple and scalariform plates (Goldblatt et al. 1985). Some of these genera were often placed in a family of their own (*Goupia*) or accommodated in other families (*Empleuridium* in Rutaceae). Scalariform perforation plates are therefore rarely encountered in the core Celastraceae.

Although exceptions exist (Table 3), the presence of scalariform perforation plates is considered an important taxonomic feature of wood type A, thus supporting the recognition of the segregates *Crocoxylon* and *Elaeodendron*.

In the past, considerable confusion existed regarding the taxonomic usefulness of scalariform perforation plates in *Cassine* s.l. The inconsistent application of names of both *Elaeodendron* and *Cassine* to southern African species, e.g. in Metcalfe & Chalk (1950) and Blakelock (1956), led to the misconception that the presence of scalariform perforation plates could not be used as a taxonomic criterion. Up to now only a small number of species of *Elaeodendron* have been examined (Loesener 1894, 1942; Moll & Janssonius 1908; Record 1938). More wood anatomical studies on extra-southern African species of *Cassine* s.l. are required to establish the consistency and usefulness of scalariform perforation plates as a taxonomic character.

According to Zhang Xinying et al. (1990) large vessel-ray pits occur in only a few celastratraceous genera, namely *Bhesa, Elaeodendron, Denhamia* and *Perrottetia*. However, no supraspecific differences were observed in vessel pit dimensions of *Cassine* and *Elaeodendron*. Large vessel-ray pits were not observed, except in one sample of *C. stuhlmannii*.

Under SEM very weakly defined vestures were seen in the vessel-fibre pits of *C. papillosa*. The structure and taxonomic value of these vestures require further study.

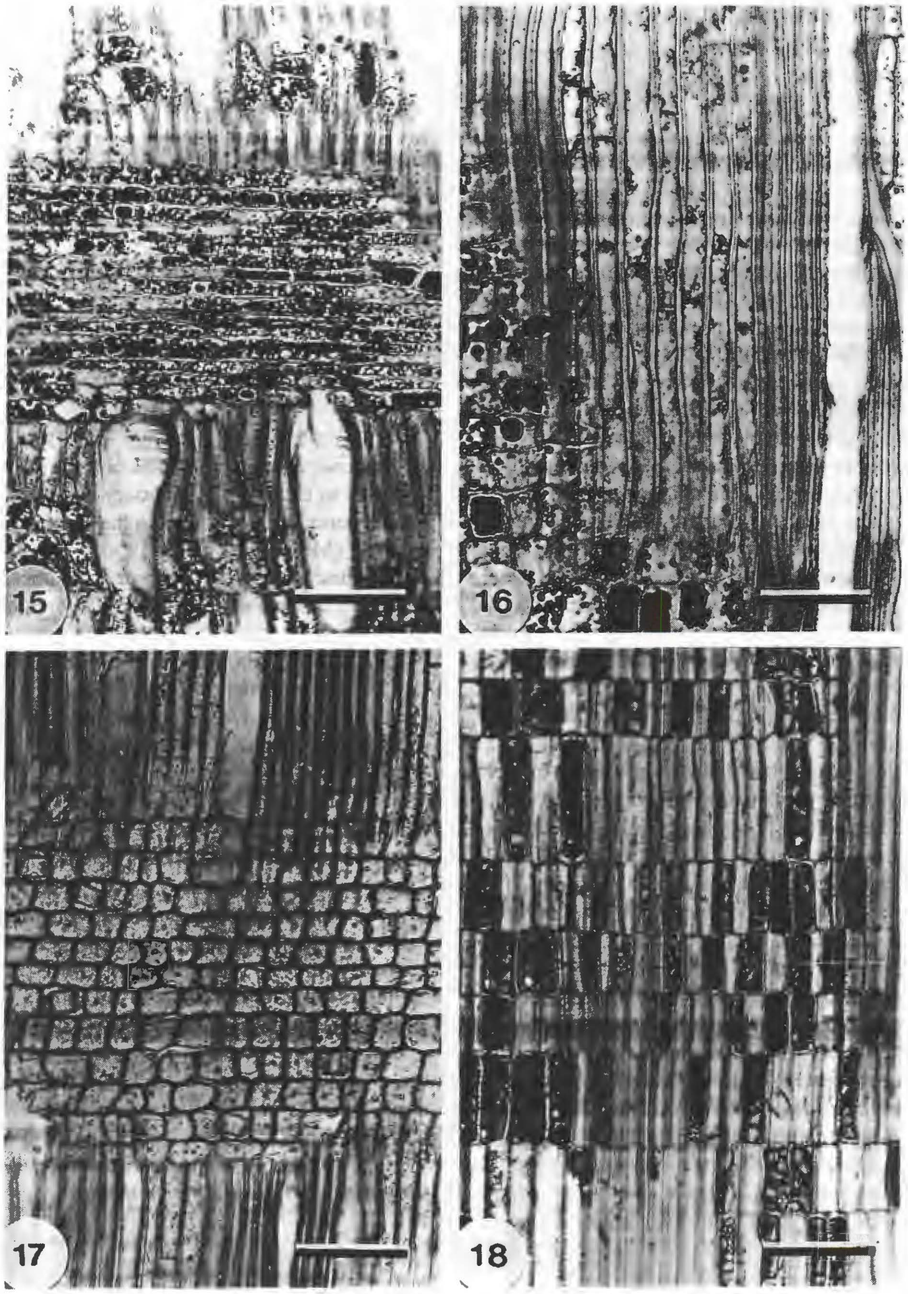
Imperforate tracheary elements

Vasicentric tracheids have not yet been recorded in *Cassine* s.l. Although they have been reported to be common in the Hippocrateoideae (Metcalfe & Chalk 1950; Mennega 1972), they appear to be absent in southern African members of this subfamily (unpublished data).

Carlquist (1988a) described the imperforate tracheary elements of *Catha, Elaeodendron, Celastrus* and *Maytenus* as septate libriform fibres, septate fibre-tracheids and tracheids as well as vasicentric tracheids. We prefer to use the term fibre-tracheids rather than tracheids in this study. The fibres usually have bordered pits, 2–5 µm in diameter. These are apparently not conductive and are distinctive in most taxa. Pits are frequent on both radial and tangential walls. This corresponds with most definitions of fibre-tracheids (Metcalfe & Chalk 1983; Carlquist 1988b; IAWA Committee 1989).

Fibre-tracheid length (Table 2) is fairly constant for a species or wood type, and could be useful for the differentiation of species or genera. Although we only measured the length of a few septate fibres, these tend to be shorter than the fibre-tracheids.

Figs. 9–14. TLS – 9: *Cassine transvaalensis* (Archer 245), rays multiseriate. – 10: *Hartogiella schinoides* (Van Jaarsveld 10580), rays 1- or 2-seriate. – 11: *Cassine peragua* (Archer 257), rays 2- or 3-seriate. – 12: *C. reticulata* (Van der Walt s.n.), rays uniseriate. – 13: *Allocassine laurifolia* (Van Wyk A1073), rays uniseriate with all cells conspicuously upright. – 14: *Cassine aethiopica* (Archer 244), rays multiseriate, fibres left and axial parenchyma right. – Scale bar = 100 µm.



Figs. 15–18. RLS – 15: *Cassine crocea* (Archer 366), rays heterogeneous, note scalariform perforation plates. – 16: *Hartogiella schinoides* (Van Jaarsveld 10580), thin-walled septate fibres. – 17: *C. reticulata* (Van der Walt s.n.), ray with predominantly square cells. – 18: *Allocassine laurifolia* (Van Wyk A1073), ray with upright cells. – Scale bar = 100 µm.

Multiseriate bands of thin-walled septate libriform fibres, 3–12 cells wide, occur among the fibre-tracheids in most of the species. These bands are comparable in distribution and appearance to the bands of axial parenchyma in *C. aethiopica, C. burkeana, C. eucleiformis, C. maritima* and *Pleurostylia*. Broad bands of either parenchyma or septate fibres are characteristic of *Cassine, Celastrus* p.p., *Elaeodendron* p.p., *Fraunhofera, Maytenus* p.p. (spiny members = *Gymnosporia*), *Hartogiella, Maurocenia* and *Plenckia* (Metcalfe & Chalk 1950). Metcalfe and Chalk (1950) added that "these bands of septate fibres are exactly comparable in distribution with the multiseriate bands of parenchyma occurring in other species, and in a single genus the bands may be composed of septate fibres in one species and of parenchyma in another." This type of fibre dimorphism has been described in many other groups, including Melastomataceae (Ter Welle & Koek-Noorman 1978) and Lythraceae (Baas & Zweypfenning 1979). A possible close functional relationship between axial parenchyma cells and thin-walled septate fibres has been suggested (Carlquist 1975, 1988b; Ter Welle & Koek-Noorman 1978).

Spackman & Swamy (1949), following a survey of 6250 species, concluded that septate fibres commonly occur in apotracheal and paratracheal patterns corresponding to those of axial parenchyma. They also noted that the proportion of septate fibres increases, with a corresponding decrease in axial parenchyma. A theory of tracheid dimorphism has been suggested by Carlquist (1988a), following a study involving taxa of six families, including Celastraceae, where tracheids (fibre-tracheids in present study) occur in combination with living, thin-walled, often septate fibre-tracheids or libriform fibres.

Mennega (1972) found that the presence of bands of septate fibres corresponded with the hippocrateaceous species with drupaceous fruits. In the species with capsular fruit, the septate fibres are inconspicuous. These groups are in accordance with Hallé's (1962) division of the African Hippocrateaceae into two subfamilies, namely the Hippocrateoideae and Salacioideae [this distinction has also been suggested by Robson (1965)].

An intermediate condition of bands composed of both septate fibres and axial parenchyma was reported in *C. glauca* and other Indian species of *Cassine* s.l. (Moll & Janssonius 1908; Ghosh & Purkayastha 1960). Our study confirms these observations. No such intermediate state was noted in the southern African species of *Cassine*. Although there is a possibility that septate fibres could grade into axial parenchyma, this was not observed by us. The distinction between septa and cell walls separating a strand of cells provides a reliable indicator of the two types of cells. The presence of either parenchyma or septate fibres is therefore an extremely useful character for the delimitation of southern African celastraceous taxa. A similar distinction between septate fibres in some species and parenchyma in another was also noticed amongst southern African species of *Maytenus* s.l. (unpublished data). The possible direction of phylogenetic specialisation in this morphological series is, however, not clear at this stage.

Axial parenchyma

Wide bands, 3–8 cells wide, of apotracheal axial parenchyma are present in five of the species (wood type C) (Fig. 20). Tanniniferous and, less frequently, crystalliferous axial parenchyma cells are present in *C. aethiopica*. However, no constant interspecific differences were noticed in wood type C. Axial parenchyma is rare or absent in wood of the remaining southern African species of *Cassine*. In these species, the bands consist of septate fibres which probably have the same function as axial parenchyma.

Except in *C. glauca*, axial parenchyma was rarely encountered in wood of foreign species of *Cassine*. Barefoot and Hankins (1982) illustrated axial parenchyma with gum content in *C. stulhmannii* [Robson (1966) considered this species synonymous with *C. schlechteriana*]. However, we are convinced that it is ray parenchyma cells that have been illustrated, not axial parenchyma.

The presence of banded axial parenchyma is considered to be taxonomically important, and is present in those species comprising the segregate genera *Mystroxylon* and Genus A. Genus A is provisional and is characterised by a different (from all other *Cassine* s.l.) floral morphology, glabrous leaves, elastic threads (trans-1,4-polyisoprene), intermediate stomatal type and a diagnostic bark type, amongst other characters (Archer 1990; Archer & Van Wyk 1992, 1993).

Rays

Rays in wood type A, part of B, and C are either heterogeneous and multiseriate with procumbent cells distinct from the marginal upright cells, or uniseriate and then usually composed of predominantly upright cells. The remaining taxa with wood type B have uniseriate rays composed of either predominantly square [*C. reticulata, C. tetragona* and *M. frangularia* (Figs. 16–19)], the latter with often biseriate rays present, or predominantly upright cells (*A. laurifolia*; related to liane habit?) (Figs. 12 & 13).

There is a slight correlation between the ray types and the proposed wood types. Wood type A always displays Kribs heterogeneous I, whereas ray types II to III are confined to the remaining two wood types.

Compared to the axial parenchyma, amorphous deposits and crystals are more frequently present in the ray cells. No constant interspecific differences in the occurrence of tanniniferous and crystalliferous cells were noticed.

Enlarged ray cells with perforations resembling the simple perforation plates of vessels have occasionally been observed in wood of species of *Cassine, Pleurostylia* and of *Maytenus* (unpublished results). These cells are difficult to detect as only a very limited number are present on a wood slide. Perforated ray cells have been reported in wood of various Celastraceae, including *C. papillosa, C. crocea*, and *C. australis* (Chalk & Chattaway 1933). Although they are more frequently observed in species of wood type A, they do not seem to be of any taxonomic value. In recent years perforated ray cells have been reported in many families, suggesting that they are widespread (Carlquist 1988b).

Miscellaneous features

Prismatic crystals of calcium oxalate are frequently present in wood of all the investigated species of *Allocassine, Cassine, Hartogiella, Pleurostylia* and *Maurocenia*. Solitary crystals occur exclusively in the axial and ray parenchyma cells. The occurrence of crystalliferous cells varies considerably between samples, and no constant interspecific differences were found. Similar crystals have also been recorded in other species of *Cassine* and many other genera of the Celastraceae (Moll & Janssonius 1908; Metcalfe & Chalk 1950), except in *Bhesa*, where they occur in chambered crystalliferous parenchyma cells (Zhang Xinying et al. 1990).

Colour of water and ethanol extracts, the burning splinter test as well as the froth test proved to be of no taxonomic value. Dyer (1988) reported a positive froth test in many samples of *Cassine*. Hitherto no heartwood fluorescence has been reported in members of the Celastraceae (Dyer 1988; Avella et al. 1989; IAWA Committee 1989), except in *Goupia*, often referred to a family of its own (Metcalfe & Chalk 1950).

Taxonomic conclusions

The presence or absence of scalariform perforation plates and the occurrence of bands of either axial parenchyma or septate fibres are probably the most important wood characters to facilitate the subdivision of *Cassine* s.l. into more natural groups. Other useful characters are the ray type and, to a lesser degree, the length of the vessel elements and fibres. Three distinctive wood types, one with three subtypes, can be recognised from the wood of the 17 southern African species examined.

The presence of scalariform perforation plates in the wood of *Elaeodendron* was used by Loesener (1942) to distinguish between *Elaeodendron* and *Cassine*. In our study a similar conclusion has been reached regarding the taxonomic usefulness of the presence of scalariform perforation plates in southern African taxa of *Cassine* s.l. (wood type A). Although the presence of scalariform perforation plates is not always consistent in wood of those foreign species of *Elaeodendron* investigated (possibly the generic identity of these taxa is questionable), it seems to be a stable taxonomic character segregating *Crocoxylon* and *Elaeodendron* from *Cassine*. Critical wood anatomical studies of most of the species of *Cassine* s.l. from as many parts of its range as possible are needed to extend current knowledge, and to evaluate the general importance of this character. The wood of southern African species of *Crocoxylon* and *Elaeodendron* is very similar.

The species included in wood type C can be recognised by the presence of bands of axial parenchyma, and correspond with *Mystroxylon, Pleurostylia* and the proposed Genus A. No significant differences in wood anatomy were found between *Mystroxylon* and Genus A. However, fibre-tracheids and vessel elements tend to be longer in *Pleurostylia capensis*.

The wood of the remaining species conforms to wood type B. This wood type is characterised by the presence of simple perforation plates and septate fibres. Species of *Cassine* s.str. can be separated from the remaining taxa of type B by the presence of Kribs' type II rays as opposed to type III rays. The similarity of the wood of *C. barbara, C. peragua* and *Hartogiella* support the inclusion of *H. schinoides* in *Cassine* s.str. The uniseriate rays of *C. parvifolia*, compared to the multiseriate rays of *Cassine* s.str. can perhaps be explained by the small stem diameter of the sample used.

Robson (1965) has described *Allocassine* with two species: *A. laurifolia* and *A. tetragona*. Codd's (1966) decision to retain only one species, *A. laurifolia*, within *Allocassine*, seems to be justified in light of its prominent, predominantly upright ray cells only encountered in this species. The wood of *C. tetragona* and *C. reticulata* is very similar, being characterised by square ray cells, supporting the placement of these species in the genus *Lauridia*. Considering observations of wood anatomy, *Allocassine* and *Lauridia* seem to be distinct from *Cassine* s.str. The wood of *Maurocenia* is very similar to that of *Lauridia*, and the two genera are probably closely related.

Wood anatomy of the investigated species, together with information from other sources (Archer 1990; Archer & Van Wyk 1992, 1993), provides strong support for the recognition of a number of genera as proposed by Loesener (1942) and Robson (1965, 1966): *Cassine* s.str., *Mystroxylon, Elaeodendron, Allocassine, Lauridia, Maurocenia* and *Pleurostylia*. There is also other evidence that facilitates the delimitation of these taxa (Archer 1990). Further wood anatomy studies on more species of *Cassine* s.l. from outside southern Africa are extremely desirable in future taxonomic studies of *Cassine* as a whole.

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APPENDIX 9

LIST OF SPECIMENS EXAMINED

Cassine peragua subsp. peragua
Abbott 79 (PRE); 93 (PRE, PRU); 178 (PRE, PRU); 1888 (PRU); 3143 (PRU); 3191 (PRU); 4132 (PRU); 4439 (PRU); 5318 (PRU); Acocks 12171 (PRE); 12324 (K, PRE); 14033 (C, PRE); 20340 (K, PRE); 21071 (K, PRE); 22243 (PRE); 23179 (K); Adamson 593 (PRE); Adamson 893 (BOL); Archer 238 (PRU); 239 (PRU); 257 (PRU); 284 (PRU); 285 (PRU); 290 (PRU); Archibald 5493 (GRA, K, PRE); Ashton FD-3270 (PRE); FD-3324 (PRE); Atherstone 105 (K); Balkwill 363 (K, PRE); Ballenden FD-6982 (PRE); Bayer 817 (PRE); Bayliss 1447 (PRE); 3232 (MO, NBG, Z); BRI.B. 908 (PRE); BRI.B. 914 (PRE); BRI. B. 1016 (PRE); BRI.B. 1385 (PRE); BRI.B. 1463 (PRE); 6308 (PRE); BRI. B. 6319 (PRE); BRI.B. 7106 (MO, PRE); BRI.B. 7381 (B, MO, S, Z); Biggs 187 (PRE); Bolus (BOL); 2224 (BOL); Botha 2241 (PRE); Bowie 1 (BM); 3 (K); 5 (PRE); Britten 1858 (GRA, PRE); 2073 (GRA, PRE); Brusse 3765 (PRE); Burchell 953 (K); 3568 (K, S); Burgers 2012 (PRE, STE); Cattell & Cattell 242 (PRE, STE); Cawe 346 (PRU); Compton 8575 (NBG); 17977 (MO); 27044 (NBG, K); Cooper 101 (PRE); 1510 (BM, K, PRE, Z); 1577 (BM, K, TCD, Z); Cruden 252 (GRA); Dahlstrand 509 (C, J, MO, PRE); 2574 (GRA, MO, STE); 2759 (GRA, MO, PRE, STE); 3017 (GRA, J, MO); Daly & Cherry 958 (GRA, Z); 12349 (PRE); Daly & Rogers 25872 (PRE); Davidson 2180 (J); Davies 34 sub Wood 7892 (K); de Villiers 165 (PRE); 166 (PRE); Deall 2279 (PRE); Dlamini PRE-30832 (PRE); Drege (MEL); Drege 1039 (K); PRE-12079 (PRE); Duthie 34 (GRA).Dyer 73 (GRA); Ecklon & Zeyher s.n. (BOL, S); s.n. (GRA); s.n. (C); s.n (C, B, MEL, Z, UPS); s.n (TCD); s.n. (C; MO); Edwards 2649 (K, PRE); Esterhuisen (BOL); 12935 (BOL); 16943 (BOL, NBG); Flanagan 397 (PRE); 783 (GRA, PRE, Z); 890 (GRA, PRE); Forest Officer FD 8638 (K, P, PRE); FD-8367 (P, PRE); FD-8358 (PRE); NBG 71011 (NBG); Fourcade 235 (BOL, GRA); 650 (BOL, GRA); 1909 (BOL); 2180 (BOL, STE); Fraser FD-6041 (PRE); Galpin 2467 (GRA, PRE); 7818 (PRE); Garside 1431 (K); Gay 23 Oct 1818 (K); Gerstner 3530 (PRE); 5170 (PRE); Hafström & Lindeberg (S); Heeg 282 (GRA); Herb. Maud (BM); Herb. Maude (BM); Hutchinson & Gillett 4400 (BM, K); Jacobson 3454 (PRE); Jordaan 1118a (PRE); Keet 31 (PRE); 31 (PRE); FD-3409 (PRE); 513 (PRE, STE); FD-2753 (PRE); 575 (GRA, PRE); 604 (GRA, STE); Killick 909 (PRE); Kluge 995 (PRE); Kruger 1261 (PRE, STE); Krynauw 33 (PRE); Linger 80 (PRE); Long 1399 (GRA, K, PRE); Lynch 22 Sept 1880 (K); Mac Owan 238 (BM, MEL); 286 (K); Marais 391 (GRA, K, PRE); 721 (GRA, K, PRE); 477 (BOL, GRA, K, PRE); 613 (BOL, GRA, K, PRE); 618 (K, PRE); 621 (GRA, K, P, PRE); 699 (BOL, GRA, K, PRE); 714 (GRA, PRE); 885 (GRA, K, PRE); 890 (BOL, K, PRE); Marloth 11863 (PRE); 3602 (PRE); 4422 (PRE); Marsh 1145 (PRE, STE); McMurtry J.B.G. 566 (PRE); McOwen 12.238.286 (TCD); Middlemost 2302 (MO, NBG); Mogg 11637 (PRE); 11668 (PRE); Moll 5493 (PRE); Mullins PRE-60792 (GRA, PRE); Mund (MEL); (S); Nicholson 929 (PRE); 1311 (PRE); 2084 (PRE); O'Callaghan, Fellingham & Van Wyk 159 (PRE, STE); 381 (PRE, STE); Olivier 1065 (NBG); 1789 (GRA); 2277 (GRA); Oliver 630 (GRA); 680 (PRU); 999 (PRU); Paterson 2295 (GRA); 3356 (PRE, BOL); 495 (PRE); 998 (BM, J, Z); Pegler 1441 (PRE); Pillans 3694 (BOL); 3704 (BOL, PRE); 9453 (BOL); 10596 (MO); Pole-Evans 4337 (K, PRE); PRE-18262 (PRE); Prior (K); Rattray 656 (GRA); Rehmann 1267 (BM, Z); Reid (Z); Robertson 551 (MO); Rogers (K); 17 (GRA); 28633 A (J, K, PRE) 28633 (BOL, STE, Z); Rottböll (C); Rourke 473 (MO, NBG); Rudatis 2132 (STE); Rycroft 3006 (NBG, STE); Salter 9560 (BM); Scharf 1138 (PRE); 1176 (PRE); 1268 (PRE); Schlechter 2674 (BM, BOL, GRA, K, MEL, NBG, P, PRE, S, UPS, Z); Schonland 3296 (PRE); 3299 (GRA, PRE); Sidey 951 (S); Sim 1521 (BOL); 1923 (GRA, NBG); 2508 (BOL, GRA, PRE); FD-3241 (PRE); FD-3297 (PRE); Smuts 1085 (PRE); 1143 (PRE); 1085 (PRE); 1095 (K, PRE); PRE-47165 (PRE); 1164 (PRE); Sparrman (S); Story 2473 (GRA, K, PRE); 2606 (K, PRE); 2690 (GRA, K, PRE); Taylor 186 (NBG); 193 (NBG); 734 (NBG); 2732 (BOL, S, STE); 7323 (K, PRE); 10413 (PRE); 10438 (PRE, STE); 10441 (K, PRE, STE); Theron 3615 (PRU); Tyson 2259 (BOL); U.P. Plant. Hons. 429 (PRU); 438 (PRU); 450 (PRU); 488 (PRU); Vahlh, (C); Van der Merve 20 (PRE); 95 (STE); Van Niekerk PRE-47180 (K, PRE); Van Wyk & Kok 5807 (PRE, PRU); Van Wyk & Mathews 7911 (PRU); Van Wyk 1115 (K); 1587 (PRE); 4497 (PRE); 4497 (PRU); 8379 (PRU); 8587 (PRU); Viviers 378 (PRE, STE); Wahlberg (S); Ward 7173 (PRE); Wells 2973 (GRA, PRE); 3606

(GRA, PRE); Willemse 186 (PRE, STE); Williams 2752 (K, MO, NBG, PRE, S); Williamson (TCD); Wolley Dod 2610[8] (BOL, K); Wood 868 (BM, GRA, MEL); 934 (BOL, K); 4137 (BOL, K, MO); 11126 (BOL, PRE); Worsdell (K).

Cassine peragua subsp. barbara
Acocks 2842 (S); 3874 (S); 4075 (S); 4120 (S); Adamson 907 (PRE); Alexander [PRIOR] (MEL, Z); Andersson (S); (S); Archer 264 (PRU); 269 (PRU); 270 (PRU); Barker 4009; 9666 (NBG); 8691 (NBG); 999 (NBG); Bayliss BRI.B. 1393 (PRE); Bohnen 4952 (PRE, STE); Bolus (BOL); 755 (PRE); 9817 (BOL, MO, PRE); Bosenberg & Rutherford 63 (STE); Boucher 507 (PRE, STE); 524 (PRE); 1843 (PRE, STE); 2982 (PRE, STE); Burgers 1860 (PRE, STE); 2123 (STE); Compton 10200 (NBG); 15698 (NBG); 17084 (NBG); 17977 (BOL, NBG); De Vos 867 (STE); Ecklon & Zeyher 2202 (S); s.n. (C, MO); Esterhuisen s.n. (BOL); Fellingham 359 (PRE); 964 (PRE); Gamble (K); Garside 496 (K); 4550 (K); Gerstner 6178 (PRE); Goldblatt 1412 (MO, NBG); Grobler 1056 (K, PRE); Hafstrom (S); Harvey s.n. (BM); s.n. (MEL, TCD); Hugo 890 (K, MO, PRE); 1698 (K, PRE, STE); 1709 (PRE, STE); Jameson (K); Kuntze (K); Leighton 486 (BOL); 1056 (PRE); Levyns 10649 (BOL); Maguire 45 (NBG); Marais 607 (K, P, PRE); 617 (PRE); Marloth 11863b (PRE); 11923b (PRE); Marsh 1451 (K, PRE, STE); Masson (BM); Maud (BM); Miers 8423 (BM); Nelson (BM); Nielsen 1535 (C); Oldenburgh (BM); Parsons 51 (K, PRE, STE); 267 (PRE, STE); Pillans 2916 (BOL); 9756 (BOL); Pole-Evans 4338 (C, K, PRE); 4341 (K, PRE); Prior (K); PRE-47169 (PRE); PRE-47172 (K, PRE); Rehmann 1612 (Z); Robertson (BM); Rogers 16056 (BM, J); Roxburg (BM); Rycroft 2100 (NBG); Schlechter 10574 (BM, K, MEL, MO, P, PRE, S, Z); Smuts 1132 (BM, PRE); 1163 (PRE); Taylor 10413 (K, STE); 1257 (K, PRE); 2593 (STE); 6836 (K, PRE); 9910 (PRE, STE); Thompson 3386 (K, PRE, STE); 3600 (K, PRE, STE); 3808 (PRE, STE); Vahl (C); Van Breda 831 (PRE); Van Der Merwe 94 (PRE); Wahlberg (S); Williams 171 (MO); Wolley Dod 1010 (BOL, K).

Cassine peragua subsp. affinis
Acocks 8613 (PRE); 17569 (BOL, PRE); Andrag 21 (STE); 77 (STE); Barker 10217 (MO, NBG, STE); Bolus STE 18317 (STE); Boucher 3603 (PRE, STE); Ecklon & Zeyher s.n. (B, C, K, MEL, MO, S, TCD, UPS, Z, ZT); s.n. (BOL); s.n.(GRA); Euston-Brown 214 (BOL, PRE); Metelerkamp 133 (BOL); 169 (BOL); 278 (BOL); Moffett 1111 (STE); Oliver 4956 (K, PRE, STE); Rourke 1973 (NBG, PRE); Story 4273 (BOL, GRA, K, PRE); Taylor 8461 (PRE, STE); 8545 (STE); 9294 (PRE, STE); 9305 (K, PRE, STE); 10953 (PRE, STE); 10995 (PRE, STE); 11793 (PRE, STE); 11969 (STE); Van der Merwe 264 (PRE, STE); Van Jaarsveld & Duncan 5732 (NBG); Van Jaarsveld 6364 (NBG); 6802 (NBG); Van Wyk 10346 (PRU); Viviers 1301 (PRE, STE).

Cassine parvifolia
Acocks 1818 (S); 21237 (BOL, K, PRE); 21491 (K, PRE); Archer 249 (PRU); 296 (PRU); Bolus 5478 (BOL, PRE); Burchell 5769 (GH, GRA, K, P); 5956 (K); Compton 7568 (NBG, PRE); 7568 (PRE); 11937 (NBG); 15785 (NBG); Durand 319 (PRE); Ecklon & Zeyher s.n. (S); Esterhuisen 12823 (BOL); 16198 (BOL); 6179 (BOL); 6815 (BOL); 23408 (BOL, K); 24010 (BOL, K, PRE); Forest Res. Officer [Taylor] 931 (GRA, PRE); Fourcade 823 (BOL, GRA, K); 2412 (BOL, K, PRE, STE); Galpin 3883 (GRA, PRE); Geertsema 413 (NBG, PRE); NBG 77993 (MO, NBG, S, STE); Gillett 151 Left (STE); Hafström & Lindeberg (S); Hutchinson 611 (BM, BOL, K, LISC, PRE); 1025 (BM, BOL, K); Keet 747 (PRE); STE 14020 (STE); Laughton 1477 (PRE); Levyns 4685 (BOL); Low 1079 (STE); Marloth 6273 (PRE, STE); 13001 (PRE); Oliver 3947 (PRE, STE); Phillips 6 (BOL, PRE); 6 (GRA); (BOL, PRE); 346 (BOL); Pillans 9604 (PRE); 9626 (BOL); Schlechter 960 (Z); Stokoe 7410 (BOL); Taylor 1181 (PRE); 1323 (PRE); 2584 (STE); 2910 (STE); 4459 (PRE, STE); 5961 (PRE, STE); 8604 (K, PRE, STE); 8662 (K, PRE, STE); 9747 (PRE, STE); Thode A774 (PRE); Van Jaarsveld 1539 (NBG); 9379 (NBG); Van Greuning 627 (PRU); Von Breitenbach 1017 (PRE); Zeyher (S, TCD).

Cassine schinoides
Abbott 4440 (PRU); Acocks 15269 (PRE); 21752 (PRE); 8612 (PRE); Adamson 3673 (UPS, BOL); Archer 251 (PRU); 253 (PRU); 254 (PRU); 258 (PRU); 563 (PRE); 564 (PRE); Barker 4507 (NBG); 8811 (NBG); Baschant (B); Bayliss 7319 (S, Z); BRI.B. 633 (PRE); BRI.B. 1230 (PRE); BRI.B. 6282 (PRE); 6280 (PRE); Boisvin (BOL); Bolus (BOL); (BOL); Bond 25 (BOL, NBG); 125 (PRE); Bos 277 (K, PRE); Boucher 425 (PRE); 883 (K); 1462 (PRE); 2279 (K, PRE, S, STE); Bowie 93 (BM); Burchell 6970 (K, S); 7225 (GRA, K, P, S); 6931 (K); Burtt Davy 18565 (MO); Compton (BOL); 22692 (NBG); 4561 (BOL, NBG); De Winter 8365 (PRE); Drege (BM); (K, PRE); Drege (S); 1923 (P); 1924 (P). Drege PRE 47252 (PRE); Drege PRE-24631 (PRE, S); Ecklon & Zeyher (C, MEL, MO) (MEL, S); (S); 307 DEC (BM, S); (UPS); (GRA); Lower part (K, TCD) (BOL); (PRE); (TCD); (Z); (Z);

(Z); Esterhuisen 2876 (BOL); 4351 (BOL); 12357 (BOL); 19264 (BOL); 30935a (BOL); 11393 (BOL); 14569 (BOL, UPS); 14945 (BOL, PRE, UPS); 16943 (PRE, UPS); 17698 (BOL, NBG, UPS); Fourcade 155 (BOL, GRA); Fourcade 3243 (BOL, K); 3529 (BOL); 6053 (PRE, STE); Garside 1431 (K); 1484 (K); 1474 (K); Geldenhuys 281 (PRE); 353 (PRE); Gillett 3375 (PRE, STE); 3421 (PRE, STE); Goldblatt & Gentry 1470 (C, NBG, PRE); Goldblatt 1701 (K, PRE); 4087 (PRE); Grey (K); Grobler 24241 (PRE); Guthrie PRE-59859 (PRE); Hafström & Acocks 2187 (PRE); Hanekom 731 (PRE, K); 2060 (K, MO, PRE); Haynes 941 (PRE); Humbert 9677 (P); Hutchinson, 1420 (K); Jacobs 39 (PRU); 40 (PRU); 41 (PRU); Keet 603 (GRA, PRE); Keet FD-2372 (PRE); Kerfoot 5094 (PRE); King FD-3553 (PRE); Kruger 414 (K, PRE, STE); Lehmann (PRE); Liebman (C); Maguire 2667 (NBG); 21870 (NBG); Marais 619 (GRA, PRE); 622 (GRA, P, PRE); 625 (BOL, GRA, PRE); 626 (BM, GRA, PRE); 627 (PRE); 632 (PRE, UPS); 633 (GRA, P, PRE); 639 (GRA, PRE); 642 (GRA, PRE); 706 (BOL, PRE); Marloth 3426 (BOL); 8443 (PRE); 11883 (PRE); Masson (BM); Michell (BOL); Muir 3155 (PRE); Muir sub Galpin 5067 (PRE); Mund (K); (SAM); Oliver 4860 (PRE); Page 16340 (BOL); Parker 4536 (BOL, K, NBG, UPS); Pearson 5154 (BOL); BOL-15542 (BOL); Phillips 1075 (BOL); Pillans (BOL); (BOL); 3703 (BOL); 3765 (BOL); 3796 (BOL); 3796 (PRE); 6776 (BOL); 7827 (BOL); 8714 (BOL, PRE); 9637 (BOL, PRE); Pole Evans PRE 47271 (PRE); Prior (K); Rehmann 2288 (Z); 2340 (Z); 2541 (Z); 971 (PRE, Z); Retzius (UPS); Robbertse 1072 (PRU); Rodin 3227 (BOL, P); 3227 (K, PRE); Rogers 1510 (Z); Rourke 545 (NBG); 693 (NBG); Schimper (Z); Schlechter 2054 (BOL, C, K, PRE); 9771 (BM, BOL, K, MO, P, PRE, S, Z); Scouler PRE-47257 (PRE); Smuts 1097 (BOL, PRE); 1111 (PRE); 1152 (BOL); sub Marloth 11911 (PRE); Story 3557 (PRE); Taylor 736 (PRE);2557 (K, PRE); 5997 (K, PRE); 7302 (PRE, STE); 10990 (PRE); Thode A773 (K, PRE); A2231 (K, PRE); A2237 (PRE); A2306 (PRE); Thunberg (S); U.P. Plant. Hons. 472 (PRU); Van Breda 269 (PRE); 1589 (K); 1734 (PRE); PRE-47268 (PRE); Van Jaarsveld 3666 (PRE); Van Rensburg 2067 (K, PRE); Van Wyk 335 (PRE); Van Wyk, Retief & Herman 6734 (PRE, PRU); 6739 (PRE, PRU); Vieillard & Delplanche (P); Wahlberg (S); Walgate 942 (PRE); Wall (S); White 5207 (PRE); Williams 1947 (NBG, STE); Zeyher (BOL); 2206 (S, Z); Zeyher 307 (PRE).

Lauridia reticulata
Acocks 12028 (K, PRE); 16149 (K, PRE); 23886 (K); Archer 569 (PRE); 562 (BOL, PRE); Brink & Mullins (GRA); Brink 387 (GRA, PRE); Britten 2074 (GRA); Burrows 2782 (GRA); Coll Uncknown (K); Cowling 379 (GRA); 631 (GRA); Dahlstrand 2506 (J, PRE); Dix 234 (BOL, PRE); Drege (BM, GRA); TM-18591 (BM, PRE, Z); Ecklon & Zeyher s.n. (B, K, PRE, S); 2198 (BM, S, TCD, Z); 431 (S); 799 (BM, K, TCD); s.n. (C, MEL, TCD, S); Fries, Tycho Norlindh & Weimarck 542 (BOL, BM, K, MO); Geldenhuis 1026 (K, PRE); 1033 (PRE); Hoole CP2 (GRA); L31 (GRA); PRE-58310 (GRA, PRE); Johnson 770 (GRA, PRE); Lubke & Wrigley 628 (GRA); Marais 387 (BOL, GRA, K, PRE); Olivier 1056 (GRA); 1570 (PRE); 2052 (GRA); 2291 (GRA); Rogers 30088 (Z); Scharf 1033 (PRE); 1537 (NBG, PRE); Story 3516 (K, PRE); Van Jaarsveld & Campher 9885 (NBG); Williamson (S, TCD).

Lauridia tetragona
Acocks 9559 (PRE); 11606 (PRE); 12077 (K, PRE); Alexander-Prior s.n. (K, Z); s.n. (K); Anthony 28 (PRE); Archer 552 (PRE); Archibald 3619 (GRA); 5568 (K, PRE); Balkwill & Balkwill 4956 (J, MO); Balkwill 1.75 (J); Bayliss 2993 (NBG); 3109 (MO, NBG); 4882 (MO); 8784 (MO); BRI.B. 6023 (PRE); BRI 1463 (K, MO, Z); PRE-1543 (Z); Bean 2627 (BOL); Bocquet 18317 (PRE); Bohnen 4125 (PRE, STE); 4901 (K, PRE, STE); Bohnen 5091 (K, MO, PRE, STE); Bolus 7323 (BOL); 3049 (BOL); 13285 (PRE); Booi 50 (GRA, K, PRE); Borle 19 (K, PRE); Botha 5855 (PRE); Boucher 2674 (STE); Bowker (MEL, S, TCD), Breyer PRE-47151 (PRE); Breyer PRE-47151 (PRE); Brink 399 (GRA, PRE); 480 (GRA, K, PRE); Britten 2934 (GRA); Burchell 3520 (BM, P, K); 3832 (P, K); 3995 (K); 4064 (K); 4295 (K); 5604 (K); 6336 (K); Burgers 1375 (STE); Burrows 3042 (GRA); Burtt Davy 14222 (BOL); Codd 1554 (K, PRE); Coleman 419 (PRE); Comins 1072 (K, PRE); Compton 26238 (NBG, PRE); Cowling 64 (GRA); Crankshaw (J); Dahlstrand 114 (J); 1765 (MO);2779 (GRA, MO, PRE); 3065 (GRA, J, MO); Daly & Janse 748 (Z); De Bunge (P); Drege 368 (PRE); 690 (GRA); 3467 (P); 6731 (P); PRE-12319 (PRE); PRE-24792 (PRE); PRE 12318 (K); PRE-9171 (PRE); Dyer 3320 (K, P, PRE); Ecklon & Zeyher (S); 2.10 (GRA); (GRA); (BOL); s.n. (C); s.n. (BOL, MEL); s.n. (S); 266 (BOL, NBG, STE, TCD); s.n. (Z); s.n. (B, TCD, Z); Edwards 2839 (B, K, PRE, Z); Esterhuisen 2992 (BOL); 23285 (BOL); Fanshawe & Bradley 21 (GRA); Flanagan s.n. (K); 124 (PRE); 166 (PRE); 172 (PRE, UPS); Forrester & Gooyer 229 (J); Fourcade 326 (BOL); 655 (BOL, GRA); 1814 (BOL); 1956 (BOL, K); 5796 (BOL, STE); 5904 (BOL, STE); 6506 (BOL); Fries & Norlindh 315 (PRE); Fries 226 (BM); Galpin 355 (PRE); 1836 (BOL; K, PRE); 2586 (GRA, P, PRE); 11275 (K, PRE); Geldenhuys 942 (PRE); Gerrard & McKen 1385 (BM, TCD); 1961 (TCD); 2066 (TCD); Gerrard 1585 (BM, K); 2786 (K); 2787 (PRE); 5203 (PRE); 6016 (K, PRE); Gobetz 64 (GRA); Gordon-Gray 648

(GRA); Guthrie PRE-59869 (PRE); Hemm 646 (J); Hilliard & Burt 13425 (K, PRE, S); Hoole (GRA); Horn PRE-47164 (PRE); Hugo 1691 (PRE, STE); Jacot Guillarmod & Brink 54 (GRA); Jacot Guillarmod 5606 (GRA); 8315 (GRA); Keet STE-14073 (STE); STE-14084 (STE); Killick 1870B (K); 2297 (PRE); Kluge 1013 (PRE); 2318 (NBG); 3318 (PRE); Leighton 1680 (BOL); Liebenberg 8059 (PRE); Liebman (C); Long 857 (K, PRE); Lubke 1858 (GRA); 2349 (GRA); 2611 (GRA); 2628 (GRA); 2770 (GRA); MacOwan PRE-47157 (PRE); Marais 393 (GRA, PRE); 455 (GRA); 592 (GRA, K, PRE); 700 (BOL, GRA, K, PRE); 722 (GRA, K, PRE); Marloth 2789 (PRE); 12717 (PRE); Martin 8021 (GRA); McAllister 148 (PRE); Medley Wood sub Galpin 3131, 3142 (GRA, PRE), 3367 (PRE); Moll 3367 (K, PRE); 3433 (PRE); 5486 (PRE); s.n. (GRA); Montgomery 156 (STE); Mund & Maire (P); Nicholson 684 (PRE); O'Callaghan 1059 (GRA); O'Callaghan Fellingham & VAn Wyk 423 (STE); Palmer 2582 (GRA); Parsons 385 (STE); Paterson 459 (BOL, Z); 495 (GRA); 3163 (GRA); Pegler 1351 (BM, BOL, PRE); 743 a (BM); Pegler 743b (GRA, K, PRE); 743c (BOL, K); Phillips 3334 (PRE); Phillipson 871 (MO); Pillans 9758 (BOL); Prior PRE-44166 (BM, PRE, Z); Rattray 325 (GRA, PRE); Rehmann 354 (Z); Rippon (PRE); Rogers 904 (GRA); 2949 (GRA); 3086 (GRA); 26818 (PRE); 26974 (Z); 26995 (K); PRE-47152 (PRE); Ross 2403 (K, PRE, STE); Rourke 1919 (MO, NBG); Rudatis 119[4]6 (BM, K); Salisbury PRE-47173 (PRE); Saunders (K); Scharf 1276 (K, PRE); Schlechter 2010 (BM, GRA, K, Z); Schonland 3572 (GRA); Schonland 3572 (PRE); Sim 2586 (PRE, UPS); Skead PRE-58311 (PRE); Smook 1265 (K, PRE); Smuts Marloth 11903 (PRE); Steiner 77 (GRA, PRE); Strey 7715; (K, PRE); 7716 (K, PRE); 8094 (K, PRE); 8766 (K, PRE); 8945 (K, PRE); 11218 (K, PRE); Symons TM-15960 (PRE); Taylor 158 (NBG); 202 (NBG); 2729 (BOL); 2729 (STE); Thode A1574 (K, PRE); Traughton 277 (GRA); Truter 560 (BOL); Tyson s.n. (BOL, PRE); BOL-13285 (BM, BOL, MO, Z) PRE-12966 (PRE); Vahlil (C); Van Wyk 911 (STE); 3204 (PRE); 4186 (PRE); 6101 (PRE); Van Zinderen Bakker 51 (K, PRE); Von Gadow 73 (GRA); 83 (GRA); 292 (GRA); Ward 5747 (PRE); Wells 3608 (GRA, K, PRE); 3615 (GRA, K, PRE); 3647 (GRA); 3782 (GRA); Williams 73 (MO); 1125 (MO); Wilman PRE 47232 (PRE); Wisura 2836 NBG); Wood 1101 (K); Zeyher 2208 (P).

Allocassine laurifolia
Abbott 813 (PRU); 1034 (NH); 1034 (PRE); 2033 (NH); 2646 (NH, PRU); Acocks 12824 (PRE); Balkwill & Balkwill 4709 (J); Balkwill & Crankshaw 80/111 (J); Balsinhas 503 (BM, K, LISC, PRE); 934 (LISC); Bayer 875 (PRE); Bootman (K); Burrows 597 (NBG, SRGH); Buthelezi 681 (NH); Chase 1868 (BM); 4181 (BM, K); 4687 (BM); 5711 (BM, K, PRE); 5798 (BM, K, PRE); 7199 (SRGH); 7384 (K, SRGH); 7766 (K); Cooper 2166 (K); 257 (NH); 280 (NH); Cunningham 2451 (NH); Gerrard & M`Ken 1592 (BM, K, TCD); 1593 (TCD); 652 (TCD); Gerstner 4490 (PRE); 5198 (PRE); Goldsmith 54/69 (SRGH); Green SP329 (GRA); Guenzius 5 (BM, K); Hunkles, Saddle & Chase 4223 (BM); Kemp 1334 (PRE); Lawn 1851 (NH); M`Ken 3 (TCD); MacDevette 370 (NH); 808 (NH); Moll 3126 (NH, PRE); Muller 1215 (LISC, SRGH). 2999 (SRGH); Nichols & Hilton-Taylor 604 (NH); Nichols 856 (NH); Nicholson 1042 (PRE); 1460 (PRE); 1850 (PRE); Plowes 2718 (K, PRE, SRGH); Rehman 8895 (Z); Ross & Moll 2310 (K, PRE); Schrire 1391 (NH); Scott-Barnes PRE-2831 (K); PRE-32103 (PRE); Sibayi Project Sp329 (GRA); Sim 20651 (PRE); Story 4126 (GRA, PRE); Swynnerton (BM); Van Wyk & Potgieter 12228 (PRU); Van Wyk 10022 (PRU); 5056 (PRE, PRU); 8296 (PRU); 8307 (PRU); 8374 (PRU); 8397 (PRU); Van Wyk BSA 1082 (PRE, PRU); Venter 3967 (K); 5871 (PRU); 6328 (PRE); Ward 1144 (NH); 1825 (NH, PRE); 2826 (NH, PRE); 5952 (K, PRE); 862 (PRE); Wild & Chase 5568 (K, SRGH). Wood 1583 (NH); 1585 (BOL); 1858 (K); s.n. (MEL); Wylie 9140 (NH); Wylie sub Wood 8591 (BOL, MEL).

Maurocenia frangula
Burchell 255 (K); Guenzius (S); MacOwan 580 (BOL, BM, PRE, Z); Marais 601 (BOL, PRE); 606 (PRE); Marloth 97 (PRE); 5978 (PRE); 12044 (PRE); Masson (BM); Maude (BM); Oldenburg (BM); Pole Evans 4349 (PRE); Prior PRE-47256 (BM, MEL, PRE, Z); Rehman 1265 (Z); 1609 (Z); Rourke 1855 (NBG, PRE); Schinz (Z); Schlechter 700 (Z); Smuts 1154 (PRE); Stauffer & Esterhuysen 5123 (PRE, Z); Taylor 3296 (PRE); 7301 (PRE); 10531 (C, PRE); Thunberg (S); Van Jaarsveld 3154 (PRE); 3171b (PRE); Van Wyk BSA 142 (PRU); Wolley Dod 1045 (BM).

Robsonodendron eucleiforme
Abbott 186 (PRE); Acocks 11685 (PRE); 13435 (PRE); Archer 469 (PRE); 528 (PRE); 570 (PRE); 1036 (PRE); 1038 (PRE); Balkwill & Balkwill 4416 (J); 6364 (J); 6495 (J); Balkwill et al. 1343 (C, K, MO, PRE, S); Bird 1293 (BOL); Bolus & Wolley Dod; GRA); Bos 741 (PRE, STE); 901 (B, LISC, PRE); Botha 3025 (PRE); 3072 (PRE); Bowie 3 (BM); Bremekamp & Schweickerdt 73 (PRE); 416 (PRE); Buitendag 1288 (NBG, PRE); Burchell 5536 (K); Burrows 2784 (GRA); Burtt Davy 5266 (K); Buthelezi 649 (PRE); Codd 3029 (K, PRE); Codd & Dyer

9141 (K, PRE); Compton 31499 (K, NBG, PRE); 32307 (PRE); Cooper 68 (PRE); 99 (PRE); 162 (PRE); 172 (K, PRE); 261 (PRE); Davidson & Mogg 32915 (PRE); 32940 (J, K, PRE); 33346 (J, LISC, PRE); 33489 (UPS); Davidson 363 (J); 434 (J); Davidson s.n. (J); Devenish 1146 (K, PRE); Ecklon & Zeyher s.n. (PRE); s.n. (BOL); s.n. (Z); Edwards 2652 (K, PRE); Esterhuisen 28981 (BOL) 30951 (BOL); 32438 (PRE); Fair 1969 (J); Fourcade 1452 (BOL, STE); 1902 (BOL); Fourie 3037 (PRE); Galpin 13348 (K, PRE); Garland 339 (PRE); Geldenhuis 235 (PRE); 266 (PRE); Gerrard 1157 (K); Gerstner 2489 (MO); 3238 (K, MO, PRE); 3239 (MO); 3225 (PRE); 4389 (PRE); 4482 (PRE); 5991 (PRE); Hemm 55 (J, PRE); Hoole (GRA); Hugo 2115 (PRE, STE); Jacobsen 2731; 2967 (PRE); Jacot Guilarmod 8608 (GRA); Keet 12 (PRE); 707 (PRE, STE); 708 (PRE); 709 (PRE); 885 (STE); FD 3818 (PRE); PRE-47066 (PRE); STE 14038 (STE); Kerfoot, Gooyer & Eastman (J); Kluge 1068 (PRE); 1080 (PRE); 1311 (PRE); MacDevette 222 (K, PRE); 604 (PRE); Maguire 434; 459 527 (J);2669 (BOL, NBG, PRE); 2922 (J); 8052 (J); 22180 (J); 22619 (J); J-28274 (PRE); Marais 388 (K); 389 (GRA, PRE); 718 (GRA, K, LISC, PRE); 720 (BOL, GRA, K, P, PRE); McClean 334 (K, MO; PRE); Mogg 13809 (K, PRE); 28244 (PRE); 28272 (K, PRE); 28244 (PRE); 28272 (J); Moll & Müller 5673 (MO, PRE); Moll & Nel 5615 (K, PRE); Moll 5014 (K, PRE); C), 5621 (PRE); 6007 (BOL); Muller & Scheepers 197 (K, PRE); Nicholson 718 (PRE); O'Connor PRE-10222 (K, PRE); Olivier 871 (GRA); Pentz 294 (K, PRE); Pillans 4332 (K); Pole-Evans 3624 (K, PRE); Prior 278 (K, PRE); Reid 25 (PRE); Ross & Moll 5104 (K, PRE); Rourke 1809 (NBG); Rycroft 2808 (NBG, STE); Scharf 1118 (K, PRE); 1150 (PRE); 1175 (PRE); 1260 (PRE); 1402 (PRE); 1426 (PRE); 1485 (K, PRE); 1535 (NBG); 1635 (K, PRE); 1635 (NBG); Schlechter 2377 (C, GRA, PRE); Sibayi Project 129 (GRA) Sim 20409 (PRE); 2469 (BOL, GRA); PRE-47060 (PRE); Smith 43; 44 (PRE); Smuts & Gillett 3567 (PRE); Smuts 14, 100 (PRE); Sørensen 389 (C); Stalmans 1966 (J); Story 4008 (GRA, K, PRE); Strey 6895 (PRE); 6904 (PRE); 7246 (K, PRE, S); 8910 (K, MO, PRE); 8954 (K, PRE); 9858 (K, PRE); Taylor 10149 (PRE, STE); Thode A2435 (PRE); Van der Schiff (PRE); 6223 (PRE); Van der Schiff 4876 (PRE); 5145 (PRE); 5998 (PRE); 6192 Van Der Schijff 4499 (K, PRE); 4641 (PRE); 4761A (PRE); 4845 (PRE); Van Jaarsveld 9348 (NBG); Van Wyk 1242 (K, PRE, STE); 1588 (PRE); 4097 (PRE); 4499 (PRE); Venter 1034 (K, PRE); 11748 (PRE); 8733 (PRE); Wenning 8 (K, PRE); White 10367 (PRE); Wood 10171 (PRE); 9403 (J, PRE, Z); Worsdell (K); Wylie sub Wood 7541 (BM, K); Wylie sub Wood 8502 (BOL, PRE); 10165 (BOL, PRE); Wylie sub Wood 9115 (GRA, MEL).

Robsonodendron maritimum

Acocks 18329 (K, PRE); 22945 (K, PRE); Adamson 1815 (BOL, P); Archibald 3650 (GRA, K, PRE), 5304 (GRA PRE); Bean 537 (BOL); Bohnen 4884 (K, PRE, STE); Bolus 4767 (BM, K); Boucher 1736 (STE); 1928 (K, PRE, STE); Bowie s.n.(BM); 10 (BM); Bowker (K); Britten 2926 (GRA; PRE; 5103 (GRA); Burchell 5320 (K, PRE, S); Burgers 2122 (PRE); Burrows 3128 (GRA); 3324 (GRA); 3460 (GRA); Burtt Davy 7858 (BOL); Collector unknown 1402 (S); Compton 9171 (NBG); 13258 (NBG); Cowling 27 (GRA); Dahlstrand 118 (C, J, PRE), 120 (J, MO, PRE), Ecklon & Zeyher s.n. (S). Esterhuysen 29611 (BOL, MO); Fourall 192 (NBG); Fourcade 1813 (BOL, STE); Fourcade 1978 (BOL, GRA); Fourcade 3273 (BOL, K, PRE, STE); Galpin 1847 (BOL, PRE); 10698 (PRE); Herbarium Normale Autro-Africanum 307 (BM, K); Humbert 9430 (PRE); Kapp 66 (PRE); Keet 562 (GRA, PRE, STE). Kemsley [2]317 (GRA); Leighton 1777 (BOL); Levyns 3782 (BOL); 10592 (BOL); Long 427 (GRA, K, PRE), 1372 (GRA, K, PRE); Lubke 2341 (GRA); 2759 (GRA); MacOwan s.n. (K); Marais 614 (GRA, K, P, PRE); Marloth 11956 (STE); Mogg 11811 (PRE). Muir s.n. (BOL); Nichol NBG-11597 (NBG); O'Callaghan 1074 (GRA); O'Callaghan, Fellingham & Van Wyk 434 (PRE, STE); O'Callaghan, Fellingham & Van Wyk 476 (PRE, STE); Oliver 5731 (STE); Olivier 1797 (PRE, STE); Olivier 2278 (GRA); 2827 (GRA); 2942 (GRA); 2777 (GRA); Page NBG-95166 (NBG); Paterson 1126a (PRE); 1126b (GRA, PRE); 2287 (BOL, PRE); Pillans 10593 (PRE); 11956 (PRE); Prov;Admin;Nature Conservation 207 (PRE); Rogers 2993 (K); Rourke 431 (B, PRE); Salter 247/35 (BM); Sim 10 (GRA); 13 (PRE), 2604 (PRE); 2343 (BOL, PRE); D18 (PRE); s.n. (PRE); Smuts (BOL); 1133 (PRE); Story 2701 (PRE); Taylor 3183 (STE); 3459 (PRE, STE); 4278 (PRE, STE); 3798 (K, PRE, STE); 6745 (K, PRE, STE); 7313 (PRE, STE); 9302 (K, MO, PRE, STE); 9902 (STE); Tyson 141 (GRA); s.n. sub TM 17243 (PRE); s.n. (PRE); van der Walt 207 (STE); Van Jaarsveld 3176 (PRE); 3198 (PRE); White 5117 (PRE); Williams 274 (K, MO); Williamson 155 (GRA).

Mystroxylon aethiopicum subsp. aethiopicum

Acocks 9243 (PRE); 9440 (PRE); 9755 (PRE); 11087 (PRE); 13274 (PRE); 16140 (PRE); 23909 (PRE); Archer & Archer 2025 (PRE, PRU); Archer 287 (PRU); 301 (PRU); Archibald 5548 (GRA, PRE); Barnard 537 (PRE); Bayer 719 (PRE); Bayliss BRI.B. 392 (PRE); BRI.B. 758 (PRE, Z); BRI.B. 1136 (PRE); 1154 (PRE); BRI.B. 1411 (PRE); BRI.B. 6039 (PRE); BRI.B. 6188 (PRE); BRI.B. 6248 (PRE); BRI.B. 6250 (PRE); BRI.B. 7038 (PRE); BRI.B. 8912 (B, GRA, MO); Bean 861 (BOL); Bohnen 4882 (PRE); 5013 (PRE); 5093 (MO, PRE, STE); Botha

3037 (PRE); 3546 (PRE); Bovin 2168 (P); Brink s.n. (PRE); Britten 1838 (PRE); 1888 (PRE); 2103 (PRE); 6617 (PRE); Burrows 2824 (GRA); Burtt Davy 14241 (PRE); 14281 (BOL, PRE); Cheadle 762 (PRE); Clarke 490 (PRE); Cowling 1505 (GRA); Dahlstrand 2848 (GRA, MO, PRE); De Winter 7609 (B, PRE); Dix 179 (PRE); Drege 6736 (PRE); Dyer 2242 (PRE); Ecklon & Zeyher s.n. (C, S, SAM, Z); 2200 (B, C, GRA, MEL, P, PRE, S, Z); s.n. (C, GRA, MEL, P, S, SAM); Esterhuysen 28764 (BOL, K); Flanagan 308 (PRE); 2358 (PRE); Galpin 263 (PRE); 7337 (PRE); 7786 (PRE); 8091 (PRE); 8261 (PRE); 9847 (PRE); Geldenhuys 306 (PRE); 307 (PRE); 308 (PRE); 522 (PRE); 526 (PRE); 932 (PRE); Gibbs Russell 3894 (GRA, PRE); Giffen 972 (PRE); Heinecken 174 (PRE); Herman 838 (PRE); 882 (PRE); Hobson 1061 (GRA); 1135 (GRA); Horn SKF no 2307 (PRE); Hutchins 2889 (PRE); Hutchinson 1594 (PRE); Jacot Guillarmod 8152 (GRA); 9566 (GRA, PRE); Jennings s.n. (GRA); Jubb s.n. (GRA, PRE); Keet 4 (PRE); 5 (PRE); 584 (PRE); Killick 769 (PRE); LLoyd 106 (GRA); Lubke s.n. (GRA); 2366 (GRA); Marais 406 (BOL, PRE); 453 (PRE); 459 (BOL, GRA, PRE); 467 (BOL, GRA, PRE); 520 (GRA, PRE); 538 (BOL, GRA, PRE); 572 (BOL, GRA, PRE); 703 (GRA, PRE); 705 (PRE); 723 (GRA, PRE); 731 (GRA, PRE); 767 (BOL, GRA, MO, PRE); Marloth 7294 (PRE); 12606 (PRE); Martin 4483 (PRE); Meyer 6146 (PRE); Mogg 11670 (PRE); Nicholson 1063 (PRE); O'Callaghan 1010 (GRA); 1021 (GRA) 986 (GRA); 1106 (GRA); 1130 (GRA); Olivier 1055 (NBG); 2633 (GRA); 3021 (GRA); Osborne 44 (GRA); 229 (PRE); Palmer 122 (GRA); 2548 (GRA); Paterson 18 (Z); Phillipson 1112 (GRA, MO, PRE); Salisbury 55 (PRE); Scharf 1752 (NBG; PRE); Sim 73 (PRE); 3394 (PRE); Story 264 (PRE); 2631 (GRA, PRE); 2631 (PRE); 3210 (PRE); 3247 (GRA, PRE); 3248 (PRE); 3249 (GRA, PRE); 3677 (PRE); Taylor 2911 (BOL); 7981 (PRE); 4438 (PRE); 10437 (PRE); Thode A2623 (PRE); Thunberg Herb. 7429 (S); Tyson s.n. (PRE); 17259 (PRE); Van Wyk 3165 (PRE, PRU); 3261 (PRE, PRU); Von Gadow 307 (PRE); Von Teichman 344 (PRE, PRU); Wells 3174 (PRE); Zeyher 2201 (MEL, Z).

Mystroxylon aethiopicum subsp. burkeanum
Archer 204 (PRE); Behr 830 (PRE); Bredenkamp 41 (PRE); 372 (PRE); 447 (PRE, PRU); 512 (PRU, PRE); 648 (PRE); 806 (PRE); 808 (PRE); Coetzee 110 (PRE); 148 (PRE); 669 (PRE); 750 (PRE); 1142 (PRE); De Winter 9273 (PRE); 9309 (PRE); 9497 (PRE); Gilfillan 172 (PRE); Glen 2164 (PRE); Hutchinson 2330 (BOL, K, PRE); Jacobson 1658 (PRE); 1706 (PRE); Joffe 930 (PRE); Leendertz 461 (PRE); 634 (PRE); Louw 1548 (PRE); Marais 895 (PRE); Mogg 2285 (PRE); 14756 (PRE); 14759 (PRE); 15100 (PRE); 15236 (PRE); 16060 (PRE); 20474 (PRE); 22375 (PRE); 24325 (PRE); J28402 (PRE); 30540 (PRE); Phillips 327 (PRE); 506 (PRE); 1265 (PRE); Pole Evans 251 (PRE); 363 (PRE); 4496 (PRE); PRE-19473 (PRE); Pont 766 (PRE); Prosser 1660 (PRE); Rehmann 4099 (BM, K, Z); Repton 204 (PRE); 539 (PRE); 740 (PRE); 1691 (PRE); 4900 (PRE); Smith 2211 (PRE); 3441 (PRE); Smuts & Pole Evans 1496 (PRE); Smuts 1410 (BOL, PRE); Story 815 (PRE); Sutton 797 (PRE); 864 (PRE); 912 (PRE); 1141 (PRE); 1142 (PRE); Theron 2679 (PRE, PRU); Thode 1305 (PRE); Van Rooyen 2228 (PRE, PRU); Van Vuuren 255 (PRE); Van Wyk 428 (PRE, PRU); 6941 (PRE, PRU); Verdoorn 432 (PRE); 445 (PRE); 582 (PRE); Wells 2281 (PRE); Zeyher 309 (BM, MEL, P, PRE, S, TCD, S).

Mystroxylon aethiopicum subsp. macrocarpum
Balkwill & Balkwill 4705 (J, MO, PRU); Cooper 127 (NH, PRE); Drege 5612 (S); Edward 2832 (PRE); Gerrard & McKen 1381 (BM (PRE); TCD); Moll 4936 (PRE, S); Morris 728 (PRE); Nichols 858 (NH, PRE); Nicholson 1305 (PRE); Pegler 713 (BM, BOL, PRE); Schrire 1402 (NH, PRE); Story 4037 (GRA); Strey 7612 (PRE); Strey 10563 (PRE); Van Wyk & Mathews 7744 (PRE); Van Wyk 5327 (PRE, PRU); 8101 (PRU); 10469 (PRU); Venter 1044 (MO, PRE); Ward 6773 (PRE).

Mystroxylon aethiopicum subsp. schlechteri
Acocks 10481 (PRE); 10572 (PRE); 10821 (PRE); 12899 (PRE); 13029 (PRE); 13092 (PRE); 20957 (PRE); Archer 328 (PRE); 334 (PRU); 379 (PRU); Balkwill et al. 1722 (NU, PRE, S); Balkwill & Balkwill 4459 (J, PRE, PRU); Barrett 27 (PRE); Bayer 1392 (PRE); 1482 (PRE); Botha 2356 (PRE); Bouquin 446 (PRE); Bredenkamp 1199 (PRU); 1936 (PRE); Burger 30 (PRE); 381 (PRE); 522 (PRE); Burrows 3506 (J, MO); Codd & De Winter 5103 (PRE); Codd 1941 (PRE); 2078 (P, PRE); 4361 (PRE); 5499 (PRE); 6522 (PRE); Coetzee 1384 (MO, PRE); Compton 28110 (PRE); 29055 (PRE); 29087 (PRE); 30744 (NBG, PRE); 31627 (PRE); 31670 (PRE); 31700 (PRE); 32128 (PRE); 32170 (PRE); 32434 (PRE); 32542 (PRE); Culverwell 139 (PRE); 168 (PRE); 1278 (PRE); De Winter & Killick 8909 (PRE); De Winter & Vahrmeijer 8461 (PRE); Dlamini (PRE); NBG 32789 (NBG, PRE); Downing 474 (PRE); Dutton 5 (PRE); Edwards 1280 (PRE); 2253 (PRE); 2717 (PRE); Galpin 9216 (PRE); Garlick 12 (PRE); Gay & Ward 77 (PRE); Gerstner 4024 (PRE); 4732 (PRE); 5383 (PRE); Glen 1769 (PRE); Hafström & Acocks 892 (PRE); Hemm 153 (PRE); Jacobsen 1983 (PRE); Johnson 1420 (PRE); Jordaan 38 (PRE); Kemp 831 (PRE); Klopper 60A (PRE, PRU); 60 (PRE, PRU); Krige 116 (PRE); 181 (PRE); Krynauw 758 (PRE); 842 (PRE);

Leistner et al. 3294 (PRE); Marais 794 (GRA, PRE); Matthews 1043 (PRE, PRU); McClean TRV34113 (PRE); Medley Wood 11406 (NH, PRE); Mogg 14408 (PRE); 24440 (PRE); 37309A (PRE); Moll 2813 (PRE); 2843 (PRE); 3317 (PRE); 4373 (PRE); 4963 (PRE); Nel 138 (NBG, PRE); Nel 146 (NH, PRE); Nel 150 (PRE); Nicholas 1357 (MO, PRE); Nichols 864 (PRE); Obermeyer et al. 237 (PRE); Onderstall 253 (PRE); Pentz & Acocks 10717 (PRE); Pentz 297 (PRE); Phillipson 3302 (GRA, PRE); Pienaar 32 (PRE); 578 (PRE); 887 (PRE); Pole Evans 2654 (PRE); 2664 (PRE); 3708 (PRE); 3743 (PRE); Porter 299 (PRE); Prior 129 (PRE); 168 (PRE); 408 (PRE); Raal 274 (PRE); 299 (PRE); 319 (PRE); Reid 701 (PRE); Retief 169 (PRE); Rodin 4609 (PRE); Ross (PRE); 1955 (PRE); 2030 (PRE); Ross & Moll 5086 (NH, PRE); Schlieben 7411 (B, Z); Schweickerdt & Verdoorn 576 (PRE); 577 (PRE); Scott 153 (PRE); Sim 19223 (PRE); Smuts & Gillett 3140 (PRE); 3141 (PRE); 3144 (PRE); Smuts 2071 (PRE); 2072 (PRE); Stephen & Van Graan 1288 (PRE); Stephen 13 (PRE); 722 (PRE); 778 (PRE); Steward 212 (PRE); Story 1651 (PRE); Strey 3799 (BM, PRE); Theron 2556 (PRE); Tinley 41 (PRE); 128 (PRE); 395 (PRE); Tscheuschner (PRE); Vahrmeijer 618 (PRE); 638 (PRE); 713 (PRE); Van der Schijff 60 (PRE); 295 (PRE); 338 (PRE); 1064 (PRE); 6587 (PRE); Van Graan & Hardy 502 (MO, PRE); Van Greuning 294 (PRE, PRU); 521 (PRE, PRU); 548 (PRE, PRU); Van Warmelo 86 (PRE); Van Wyk & Theron 4896 (PRE, PRU); Van Wyk BSA 682 (PRU); Van Wyk 5190 (PRE); 5612 (PRU); 5707 (PRE, PRU); 6657 (PRE, PRU); Venter 1175 (PRE); 1178 (PRE); Venter 4042 (PRE); 4807 (PRE); 4824 (PRE); 5856 (PRU); 6154 (PRE); Wager TRV 22415 (PRE); Ward 22 (PRE); 1501 (PRE); 2173 (PRE); Watt & Brandwijk 1261 (PRE); West 1191 (PRE); 1459 (PRE); 1557 (PRE); White 10350 (PRE); Young A543 (PRE); Zambatis 1719 (PRE); 1723 (PRE).

Elaeodendron croceum
Abbott 6348 (PRE); Acocks 8966 (K, PRE); 11651 (PRE); 12139 (PRE); 12738 (K, PRE); 21058 (PRE); 21171 (PRE); Balkwill & Cron 302a (J, PRE); Barklay & Acocks 935 (PRE); Bos 857 (B, LISC, STE); Botha 2241b (PRE); 3106 (PRE); Bowie (BM); Burchell 5237 (K, S); 5271 (K); 5279 (K); 5411 (P); 5527 (K); 5572 (K, S); 5715 (GRA, K, P, S); 6050 (K, P, S); Burrows 2276 (SRGH); Burtt Davy 1242 (BOL); Buthelezi 666 (PRE); Carnegie 1666/28 (NBG); Chase 8475 (K, SRGH); Codd 1480 (K, P, PRE); Compton 21711 (NBG); Crook 305 (K, MO, PRE, SRGH); Dahlstrand 483 (PRE); 487 (J); Davidson 1832 (J); De Vries 114 (PRE); De Winter 8829 (PRE); Drege (BM); Drege (K); Drege (S); Duthie 21 (GRA); 605 (BOL); Dyer 120 (GRA); 121 (GRA); Ecklon & Zeyher (MEL, S); (MEL); (S); (TCD); (Z); 2191 (S); Edwards 809 (K, PRE); 855 (PRE); 1506 (K, PRE); 2093 (PRE); 2308 (K, PRE); Flanagan 346 (PRE); 393 (PRE); 862 (GRA, MO, NBG, P, PRE, Z); Fourcade 382 (BOL, GRA); 569 (BOL, GRA, Z); 1460 (K); 1913 (BOL); Furness & Phillipson 265 (MO, PRE); Galpin 3885 (GRA, PRE); Geldenhuis 264 (PRE); 265 (K, PRE); Gerrard & M'Ken 1382 (TCD); Gerstner 4442 (PRE); 6092 (PRE); Giffen 773 (MO, PRE); FH-2259 (PRE); Gillett 1336 (BOL, STE); Goldsmith 128/67 (K, PRE, SRGH); 196/62 (BM, P, SRGH); 25/71 (K, PRE, SRGH); 27/71 (B, J, K, MO, P, PRE, SRGH); Gordon-Gray 464 (GRA); 639 (GRA); 1173 (GRA); Grant 3244 (MO); Green Sibayi Project-333 (GRA, PRE); 335 (GRA); Hack 129/50 (K, MO, SRGH); Haughton Sept 1864 (K); Heinecken 180 (PRE); Hemm 484 (J); Herb. MacOwanianum 1685 (BM); Hiemstra & Wisura 311/73 (NBG); Hill 4784 (GRA); Hoole (GRA); Jacobson 5451 (PRE); Jacot Guillarmod 5498 (PRE); 8156 (GRA); 8162 (GRA); Jenkins 6 (PRE); Johnson & Hutchings 1095 (PRE); Keet 544 (GRA, STE); 549 (GRA); 551 (GRA); 552 (GRA, PRE); Keet FD-3408 (PRE); Ken 2 (K); Killick 911 (PRE); Kraus 270 (BM, K, MO, S, TCD); Lam & Meeuse 4724 (S); Lawrence 167 (BM); Legat 68 (K); Linger 34 (PRE); Long 866 (GRA, K, PRE); Lubke sn (GRA); M'Ken & Gerrard 1859 (K, TCD); MacDevette 226 (C, K, PRE); 896 (PRE); MacOwan 713 (BM, BOL, K, P, PRE, UPS, Z); 2748 (K); Marais 468 (GRA, K, PRE); 486 (BOL, GRA, K, PRE); 488 (GRA, K, PRE); 493 (GRA, K, PRE); 527 (BOL, GRA, K, PRE); 690 (GRA, PRE); 693 (GRA, K, P, PRE); 695 (BOL, GRA, K, P, PRE); Marloth 8448 (PRE); 12704 (PRE); PRE-47227 (PRE); Marriott 5 (K, PRE); Marsh 1307 (K, PRE, STE); Masson 1797 (BM); McGregor 30/48 (SRGH); 46/38 (SRGH); Meyer 3928 (K); Miller FD-3207 (PRE); Moll 1014 (K); 2411 (PRE); 2787 (K, PRE); 2787 (PRE); 2985 (PRE); 3102 (K); 3198 (K, PRE, S); 3318 (K, PRE); 3442 (K, PRE, S); 3580 (PRE, S); 5752 (PRE); Muller & Gordon 1826 (SRGH); Muller 2983 (SRGH); 3378 (SRGH); Mund (MEL, S); (TCD); (K); Netshiungani 1456 (J, PRE); Nicholas & MacDevette 1268 (K); Nicholas 1208 (PRE); Nicholson 1312 (PRE); 1347 (PRE); 2027 (PRE); Nielsen 1617b (C); 1617c (C); O'Callaghan 950 (GRA); O'Callaghan, Fellingham & Van Wyk 158 (PRE, STE); Paetzold sub Galpin 8222 (PRE); Pahl 9 (GRA); Palmer 2670 (GRA); Paterson 2190 (PRE); Pegler 756a (K, PRE); 756b (Z); 756c (K, PRE); 756 (BOL); Pegler sub Marloth 5597 (PRE); Peter 50717 (B); 50718 (B); Phillips 183 (GRA); Phillipson 3326 (GRA); 883 (K, PRE, UPS); 1125 (MO, PRE); 900b (K, MO, PRE); Pitchford 13 (GRA); Prior (K, MEL, PRE, Z); herbarium PRE-47220 (K, PRE); Proschowsky 51144 (BM); Rehmann 8897 (Z); Renny DB50 (K, PRE); Ridley NBG 579/14 (NBG); Rogers 17178 (Z); TM-22708 (PRE); Rudatis 1768 (PRE); Rycroft 2767 (NBG); 2784 (NBG, STE); 2804 (NBG, STE); Scharf 1410 (PRE); 1520 (K, PRE); Scheepers 675 (K, PRE); Scheepers PRE-

47193 (PRE); Schlieben 7[2]193 (B, K); Sidey 693 (S); Sim 1335 (BOL); 2154 (BOL, NBG, PRE); 2117 (GRA, PRE); 3240 (PRE); Smuts & Gillett 3183 (BOL, PRE); Smuts PRE-58360 (BOL, PRE); Stalmans 1718 (PRE); Stephen 415 (PRE); Stephen, Van Graan & Schwabe 1028 (PRE); Story 363 (PRE); Strey 8740 (K, PRE); Swynnerton 1173 (BM, K, SRGH); 1174 (BM, K, SRGH, Z); 167 (K, Z); Taylor 2210 (PRE); 2563 (K, PRE, STE); 7997 (PRE, STE); Tinley 388 (PRE); Vahrmeijer & Tölken 300 (PRE); Van Der Merwe 2172 (STE); 2175 (PRE, STE); Van Wyk & Theron 4601 (PRE); 4743 (PRE); Van Wyk 2655 (PRE); 7547 (PRE); Van Wyk BSA 1197 (PRE, PRU); Van Wyk BSA 1236 (PRE, PRU); Venter 4399 (PRE); Von Gadow 213 (GRA); Ward 3390 (PRE); 6604 (PRE); Wells 2797 (GRA, PRE); 3512 (GRA); 3557 (GRA, PRE); 3733 (PRE); 3911 (GRA, LISC, PRE); Wenning 9 (K, PRE); Wild 1573 (K, SRGH); Williamson (TCD); Wood 649 (BOL); 937 (BM, K); 9910 (MEL); Worsdell (K); Wylie sub Wood 10079 (PRE).

Elaeodendron schweinfurthianum
Baagøe, Danielsen & Vollesen 20 (C); Bally 12180 (K, P, S); Dale 3528 (K); Deshmukh, Jess 437 (K); Faden & Faden 74/1067 (K, PRE); Faulkner 1585 (S); 1867 (S); 1968 (P); 1975 (P, S); 2283 (S); Frazier 2300 (MO); Gerhardt & Steiner 157 (UPS); Gillespie 99 (K); 173 (K); 249 (K); Gillet & Kibuwa 19871 (K, MO, P, UPS); Graham 755 (K); 2193 (BM); Greenway, 8868 (K); Harris 2553 (MO); 4981 (MO); Hildebrandt 1323 (BM); Katende & Lye 4793 (K); Kirk (K); (K); Ludanga 1120 (C); 1586 (C); MacNaughtan 20 (K); Magogo & Glover 1133 (K); Makin 423 (K); Musyoki & Hansen 1020 (C, K); Perdue & Kibuwa, 10229 (K); Polhill & Paulo 704 (K, P, PRE, UPS); 756 (K, PRE, UPS); Rawlins, 134 (K); June 1956 (K); Robertson, 3472 (K); Rodgers 1317 (C); Sangai 965 (K); Simpson 36 (K); Spjut 4603 (K); Vaughan 2709 (BM); Vercourt 2117 (K); Vollesen 2399 (C); Wakefield (K).

Elaeodendron aquifolium
Bally & Melville 16306 (K); Bally 2047 (K); 9327 (K); Beckett & White 1576 (K); Brien 104 (K); Deshmukh, Jess 434 (K); Gilbert, Sebsebe & Vollesen 8208 (C, K, UPS); Gillett & Hemming 24453 (K); 24766 (K, PRE); Gillett, Hemming & Watson, 22272 (K); Gillett, Hemming Watson & Julin 25234 (K); Greenway & Kanuri 12940 (K, PRE); 13049 (K, PRE); Madany 89/5 (UPS); Thulin & Abdi Dahir 6403 (K, UPS); Thulin & Bashir Mohamed 7064 (K, UPS).

Elaeodendron buchananii
Bagshawe 1320 (BM); Bally 102 (BM, K); 963 (K); 964 (K); 1159 (K); 1251 (K); 1475 (K); 4670 (K); 5444 (C, K); 7985, K); Banda 476 (BM, SRGH); Battiscombe 642 (K); Bequaert 2891 (K); Bogdan 739 (K); 2468 (K); 4551 (K); Brenan & Greenway 8179 (K); Brummitt & Synge WC231 (K); Buchanan 710 (K); Chaffey 264 (K); 1237 (K); Chandler 1102 (K); Chapman & Patel 5883 (K); Chapman, Patel & Balaka 6425 (K); Chapman 2753 (K); Clutton-Brook 505 (K); Dale 1015 (K, P, PRE); 2895 (BM, K); Dawe 977 (K); De Wilde & de Wilde-Duyfjes 8252 (C, P); De Witte 6514(C, K); Dummer 4425 (BM); Edwards 3120 (K); Eggeling 643 (K); 891 (K); 1808 (K); 1827 (K); 3106 (K); 3498 (K); 3565 (K); 5731(K); 5732 (K); Faden & Faden 74/915 (K); Fanshawe 1403 (K); 1440 (K); 1551 (K); 1695 (K); 7204 (K); 8990 (K); 10554 (K); 10341 (K); 10257 (K); 11480 (K); Freyburg EA15510 (K); Fries 206 (K); 1731 (K); Friis 281 (C); 2339 (K); Friis, Gilbert & Vollesen 4142 (C, K, UPS); 4110 (C, K, UPS); Gardner 3748 (K); Gillett & White 20239 (K); Glasgow 48/4 (K); Glover, Gwynne, Samuel & Tucker 2583 (K, PRE); Glover, Gwynne & Samuel 4 (K); 214 (K, PRE); Gossweiler 1412 (BM, K, P);12994 (BM); 12996 (PRE); 14148 (BM, K); Greenway & Field 11/1/15485 (K); Grout 25/49 (K); Guigonis & Normand 450 DN (K, P); Gutter (K); Hall & Lock 43919 (K); Hemming 231 (K); Henriques 568 (BM, K); Herkotter 664 (K); Hornby 3092 (K); Hughes 222 (K); Jackson 7530 (K); Jackson, com Lugard 318a (K, PRE); 328a (K); Kahurananga 834 (K); Kersting A269 (K); Kirika 507 (K, PRE); Letouzey 2659 (K, P); Lovett & Lovett 698 (MO, PRE); Malaisse 13306 (PRE); Meyer 9075 (K); Mungai 147/84 (K, UPS); Mutimushi 2003 (K, P); Nicholson 53 (K); Obina (K); Perdue & Kibuwa 8074 (K, UPS); Pole Evans & Erens 1163 (K, P, PRE); Procter 928 (K); 1899 (K); Rayner 6 (K); 404 (K, S); Ringoet 119 (K); Robson 555 (BM, K, PRE); Rogers 543 (K, S); 558 (K); Ruffo 1462 (K); Stolz (B, BM, MO, P, PRE, SAM); Styles 248 (K); Tanner 1834 (K); Thomerson 777 (K); Thompson E3959 (K); Trapnell 2263 (K); Troupin 5008 (K); 5079 (K); Turner, 102 (K); Van Someren 108 (K); 142 (K); Vercourt & Polhill 2983 (K, PRE); Verdcourt 3049 (K, PRE); Vollesen 2700 (C, K); 3999 (C); Warnecke 45 (K, P); Westphal & Westphal-Stevels 2929 (C); White 3196B (K); Williams 35/62 K); Wye 641 (K); 640 (K).

Elaeodendron schlechterianum
Allen 86 (K); 111 (K); Bally 120 (K); 1581 (K); Bamps, Symons & Van der Berghen 495 (SRGH); Barbosa &

Carvalho 3762 (K); 3916 (K); Barbosa & de Lemos 7611 (LISC, SRGH); 8170 (K, LISC, SRHG); 8215 (K); Barbosa 2143 (LISC); Biegham 1381 (SRGH); 2098 (K); Bond J10 (SRGH); Borhidi, Hedrén Mziray Pocs 84451 (UPS); Burrows 15/65 (SRGH); Burtt 819 (BM, K); 3372 (K); 4909 (K); 5567 (BM, K, P); Chapman 6352 (K); Chase 2286 (BM, K, SRGH); 3063 (BM, K, PRE, SRGH); 3944 (BM, K, SRGH); Cleghorn 1536 (SRGH); Cleghorn 1749 (SRGH); Correia & Marques 1476 (PRE, SRGH); 2965 (SRGH); Davies 1487 (K, SRGH); de Aguiar Macêdo 1221 (LISC); 5232 (K, LISC, PRE, SRGH); Drummond & Hemsley 4076 (K); Dudley sn (SRGH); Fanshawe 8122 (K); 9033 (K); 9844 (K); 11198 (K); Flock 106b (MO, S); Fundi, 46 (K); Gomes & Sousa 4435 (K, PRE); 4696 (K); Gordon 50 (SRGH); Greenway 2388 (K); 2467 (K); Hall-Martin 467 (SRGH); 853 (SRGH); 902 (K, PRE, SRGH); Harris & Mwasumbi 2455 (MO); Hawthorne 1744 (K); 1500 (K); Hornby 13/32 (K); 43 (K); 44 (K); 2745 (K, PRE, SRGH); Hughes 122 (K); Jansen Nuvunga & Petrini 7650 (K, PRE); Kafuli 192 (SRGH); Kirk 2/71 (K); Jul 1860 (K); Koutschoren 1715 (K); Lemos & Balsinhas 54 (BM, K, LISC, PRE, SRGH); Lindeman 147 (BM); Ludanga 1344 (C, K); 1125 (K); Luke & Robertson 1265 (K); 1538 (K); Mabberley & Mwasumbi 2615 (MO); Mabberley 1527 (K); Mendonça 2774 (K, LISC, PRE); Menyhart 1a (Z); 2a (Z); Mogg 27614 (J); 28740 (SRGH); Mucheve de Carvalho 748 (K); Mushori 12 (SRGH); Mwasumbi & Harris 10885 (B); Pedrogão 1448 (K, PRE SRGH); Perdue & Kibuwa 8492 (K, UPS); Phillips 2/70 (SRGH); Pope 1985 (MO, PRE, SRGH); Savory 692 (SRGH); Saxleux 976 (P); Semsei 1782 (K); Semsei 588 (K); Sherry 104/71 (SRGH); Tinley 1714 (B, LISC, P, PRE, SRGH); 1925 (B, LISC, PRE, SRGH); 1927 (B, K, LISC, P, PRE, SRGH); 2730 (LISC, 2702 (LISC, PRE, SRGH); Torre & Correia 14125 (LISC); Torre 5506 (LISC, SRGH); 5506 (SRGH); 7054 (LISC); 7876 (B, Z); 18022 (SRGH); Vollesen 2743 (C, K); Wallace 508 (K); Welch 384 (K); West 4537 (BM, SRGH).

Elaeodendron matabelicum

Andrada 1207 (LISC); Armitage 89/59 (B); Astle 3365 (SRGH); 4871 (SRGH); Ball 17 (SRGH, UPS); Banda 476 (SRGH); Barbosa & Balsinhas 5017 (BM); Bell 926 (SRGH); Biegel 788 (MO); 1332 (SRGH); 1608 (MO, SRGH); 2121 (MO, SRGH); 2146 (SRGH); Bingham 984A (SRGH); Blakelock 3014 (BM, PRE); Bond 9b4 (SRGH); Bond 9b116 (SRGH); Chapman, Patel & Balaka 6425 (SRGH); Chase 290 (BM); 920 (BM, SRGH); 1326 (BM, SRGH); 1565 (BM, SRGH); 3881 (BM, MO, PRE, SRGH, UPS); 3882 (BM, MO, SRGH, UPS); 5682 (BM, P, SRGH); SRGH-16249 (MO); Chiparawasha 494 (SRGH); Chubb 28 (BM); Clark 429 (SRGH); Clegham 218 (SRGH); Crozier 9/64 (SRGH); Dahlstrand 119 (C, J, MO); Darbyshire 2869 (MO); Davies 2484 (K, S, SRGH); D274 (SRGH); de Aguiar Macêdo 2237, 2239 (all SRGH); De Koning 8117 (K); Denny sn (SRGH); 128 (K); Edwards 2/36 (SRGH); English 9/47 (SRGH); Eyles 5287 (SRGH); 5703 (SRGH); 6237 (SRGH); Eyles 6308 (SRGH); 7654 (K); Furness 20/56 (K, PRE, SRGH); Galpin 7084 (GRA, PRE); Gibbs 165 (BM); 365 (BM, BOL, PRE); Gomes e Sousa 1828 (K); 1871 (COI, K); Goodier 943 (K, SRGH); Gordon 112 (SRGH); Greenhow 19/51 (B, K, PRE, SRGH); Gross 168 (MO, PRE, SRGH); Harvie 14/49 (MO); Hodgson 6/52 (MO, PRE, SRGH); Hornby 2244 (PRE); Hornby 2938 (PRE, UPS); Kennan sn (SRGH);, Masterson 145 (SRGH); Mavi 1085 (SRGH); McGregor 117/37 (SRGH); Meara 38 (PRE); Meebold (BOL); Mendonça 418 (K, LISC, P, SRGH); Miller 1918 (PRE, SRGH); 2145 (PRE, SRGH); 8290 (K, PRE, SRGH); B/1039 (PRE); B/1294 (PRE); PRE-29090 (PRE); B/919 (K, PRE); Mogg 28929 (J, K, SRGH); 29049 (LISC); 29116 (PRE); Monro 2093 (BOL, PRE); Moubray sn (SRGH); Müller & Pope 1988 (LISC, SRGH); Müller & Pope 1999 (SRGH); Norrgram 208 (B, S, SRGH); Nyariri 149 (SRGH); Orpen 62/50 (MO); Patel 84 b (SRGH); Plowes 1252 (SRGH); 1274 (SRGH); 1478 (MO, SRGH); 1640 (K, PRE, SRGH); Pole-Evans 3246(44); (PRE); Rodriques, Pereira, Marques & Balsinhas 247 (SRGH); Sim 19240 (PRE); 19285 (PRE); 19312 (PRE); 19317 (PRE); Swynnerton 1171 (BM); Torre & Correia 18262 (K, LISC, P); Torre 3878 (LISC, SRGH); 6717 (K, LISC); Tycho Norlindh et Weimarck 4812 (BM, MO, SRGH); Van Wyk BSA 1179 (PRE, PRU); West 2416 (MO, SRGH); 2985 (MO, SRGH); 2739 (PRE, SRGH); 2942 (MO, SRGH); 4935 (SRGH); 6614 (B); 6633 (P, SRGH); White 6230 (SRGH); Wilkins 6 (SRGH); Winter 1322 (MO); Yalala 205 (SRGH).

Elaeodendron zeyheri

Acocks 8954 (PRE); 8989 (PRE); 11089 (PRE); 12069 (GRA, PRE); 12069 (PRE); 13027 (K, PRE); Alexander-Prior (K); Archer 482 (PRE); Archibald 5415 (PRE); 5706 (PRE); 5893 (GRA, PRE); 6161 (GRA, PRE); Bayliss BRI 1411 (MO); BRI.B. 22 (PRE); BRI.B. 1413 (PRE); BRI.B. 22b (PRE); BRI.B. 1443 (PRE); BRI.B. 534 (PRE);BRI.B. 754 (MO, PRE); BRI. B. 1021 (PRE); BRI .B. 1050 (PRE); BRIB 1054 (PRE); BRI.B. 1159 (PRE); BRI.B. 6005 (PRE); BRI.B. 7053 (PRE); Botha 5856 (GRA); Brink 96 (GRA); Britten 2055 (GRA, PRE); Burchel 4664 (K); Burdett 109 (GRA); Burrows 2835 (GRA); 3753 (GRA); 3887 (GRA); Cannan GRA); Codd 1421 (PRE); De Carvalho 654 (K); Drege 6740 (K, P, PRE); Drege PRE-24790 (PRE); du Preez (GRA); Dyer 2243 (GRA);