LICUÁTI FOREST RESERVE, MOZAMBIQUE: FLORA, UTILIZATION AND CONSERVATION

by

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Research Project Report submitted in partial fulfilment of the requirements for the taught degree

Magister Scientiae
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Samira Aly Izidine

2003

To the glory of God

and to the memory of my dear father,

Aly Abdul Azize Izidine,

6-11-1927 – 7-03-2003

A glória de Deus

e em memória ao meu querido pai,

Aly Abdul Azize Izidine,

6-11-1927 – 7-03-2003

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LIST OF ABBREVIATIONS

DNPH	=	Dinitrophenylhydrazine
EtOH	=	Ethanol
FAA	=	Formalin-acetic-acid-alcohol
GIS	=	Geographical Information System
GMA	=	Glycol methacrylate
HEMA	=	2-Hydroxyethyl methacrylate
IUCN	=	World Conservation Union
LFR	=	Licuáti Forest Reserve
LMA	=	National Herbarium, Maputo
LMU	=	Eduardo Mondlane University Herbarium, Maputo
LISC	=	Lisbon Herbarium, Lisbon
MC	=	Maputaland Centre of Endemism
PRE	=	National Herbarium, Pretoria
PRU	=	H.G.W.J. Schweikerdt Herbarium, University of Pretoria
SABONET	=	Southern African Botanical Diversity Network
WWF	=	World Wide Fund for Nature

ABSTRACT

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A floristic study of the Thicket vegetation in the Licuáti Forest Reserve, southern Mozambique, was undertaken. Observations on the structure and range of this unique vegetation type, its species composition, level of endemism and utilisation are provided. A literature review of the physical environment, soils, climate, vegetation and flora, as well as historical background, is presented.

The Licuáti Thicket covers an area of about 14 000 ha, which is about 35% of the 40 000 ha covered by the Licuáti Forest Reserve [LFR]. A study of satellite images and aerial photographs, taken over a period of about 30 years between 1958 and 1989, indicate that no significant changes took place in the size and distribution of the Licuáti Thicket during this period.

Attributes such as common names, life history, growth form, fruit type and medicinal uses are provided for 113 plant taxa. These are presented as a checklist arranged according to family, with genera and species listed alphabetically within the families. The Licuáti Thicket contains about 13% of the vascular plants endemic to the Maputaland Centre of Endemism [MC]. The plant families Rubiaceae, Fabaceae and Celasteraceae contribute the largest numbers of endemics.

The first record of *Xylopia torrei* N.Robson from southern Mozambique is reported. An amplified description is provided for the species, supplemented by notes on the comparative anatomy of the genus in southern Africa.

The Licuáti Forest contains about 45 plants that are utilized by humans for medicinal purposes. The plant parts most commonly collected are leaves, roots and bark. The traditional leadership of the Santaca family still plays an important role in the conservation of the Licuáti ecosystem. An interview was conducted with members of the Santaca family, and some of the historical and cultural information obtained from this interview are presented in this report.

This study provides information that supports the recognition of the Licuáti Thicket as a unique vegetation type distinct from Licuáti (Sand) Forest. Both these vegetation types are endemic to the MC. I trust that this report will raise public awareness of the uniqueness of this special botanical region in Mozambique and that it will guide reserve management and sustainable utilisation programmes in the LFR.

PROJECT PROPOSAL (condensed)

1.1 Rationale and motivation

In 1994, southern Mozambique and the northern part of KwaZulu-Natal were recognised by the WWF/IUCN as a centre of plant endemism, called the Maputaland Centre [MC] (Davis *et al.* 1994). High levels of endemism, spread across virtually the whole taxonomic spectrum, including both plant and animal taxa, were highlighted (Van Wyk & Smith 2001).

The MC covers the coastal plain of southern Mozambique and northern KwaZulu-Natal, South Africa. Several conservation areas have been proclaimed in the area, including the Greater St Lucia Wetland Park (a World Heritage Site), Tembe Elephant Park, Maputo Elephant Reserve, Licuáti Forest Reserve, Mkuzi Game Reserve, and Kosi Bay Coastal Forest Reserve (Van Wyk & Smith 2001).

The vegetation of the MC is very diverse, and includes different types of grassland, bushveld, thicket, forest and swamp vegetation. Two remarkable vegetation types, Sand Forest and Woody Grassland, are endemic to the MC (Van Wyk & Smith 2001).

It is estimated that at least 2 500 vascular plant species occur in the MC (Van Wyk 1996; Van Wyk & Smith 2001), and that at least 230 species or infraspecific taxa are endemic/near-endemic to the region. Three genera, *Brachychloa, Galpinia* and *Helichrysopsis* are endemic/near-endemic to the MC. The plant families Asclepiadaceae, Euphorbiaceae, Rubiaceae, Liliaceae, Acanthaceae and Asteraceae contain the largest numbers of endemic species.

The Licuáti Forest Reserve [LFR] in southern Mozambique, was established on 14 December 1943 by portaria number 5354 (Gomes e Sousa 1968). It is located between the Tembe and Maputa rivers, and the Porto Henrique-Bela Vista and Bela Vista-Catuane roads, at 26°20' and 32°30'. The reserve and surrounding areas cover about 40 000 ha (Mangue 1999).

A rare thicket vegetation type, locally referred to as the Licuáti, occur in the LFR. The Licuáti Thicket contains many rare plant and animal species. It is very distinctive, not only because of its unique combination of plant and animal species, but also because it is more-or-less confined to the ancient coastal dunes of northern KwaZulu-Natal and the extreme southern parts of Mozambique. Because of its restricted occurrence and unusual species compliment, Licuáti Thicket is one of the most important plant communities in the MC (Van Wyk & Smith 2001). In the past, Licuáti Thicket has been classified together with Licuáti Forest as a single vegetation type sometimes also called Sand Forest.

The Licuáti ecosystem plays an intricate part in the lives and livelihoods of local communities; providing land for agriculture, timber, wild foodstuffs, building material, medicine, fuel wood, fodder, and household commodities and services. It is also a source of cultural symbols and sacred sites (Mangue 1999).

Although the LFR was created in 1943 to protect woody plant species, particularly *Afzelia quanzensis*, the enforcement of laws on timber and charcoal production is very weak, resulting in the destruction of some of the vegetation types in the reserve. Overexploitation of traditional medicinal plants is largely the result of commercialisation in urban areas, a breakdown of cultural taboos, and the introduction of more efficient harvesting implements such as cane knives and metal axes. Deforestation around the Forest Reserve due to charcoal production threatens not only the loss of plant resources, but also the indigenous knowledge systems of several endemic species (Mangue 1999). The LFR lies within the development zone of Maputo, and is under increasing pressure from extensive harvesting of wood for the production of charcoal. Since the area around the forest has been resettled, the structure and diversity of large tree species have declined notably (Bandeira, unpublished results).

The population of Maputo is estimated to be about 966 000 (INE 1997). Studies by the National Directorate of Forest and Wildlife suggest that over 80% of the Maputo population depend on fuel wood for household cooking and heating purposes. It is estimated that the annual consumption of firewood and charcoal by the urban population of Maputo City is

about 12 million tons/year. This demand is placing considerable pressure on forest resources particularly around the LFR. Presently there is no enforcement of conservation measures at LFR.

Hypothesis 1. Licuáti Thicket is a distinct vegetation type, quite different from Licuáti Forest.

Hypothesis 2. Licuáti Thicket is rich in plant diversity.

Hypothesis 3. A significant proportion of species in the Licuáti Thicket are MC endemics/near endemics.

Hypothesis 4. The species of *Xylopia* recorded from Licuáti Thicket is conspecific with *X. torrei*.

Hypothesis 5. The structure of the Licuáti Thicket has changed due to timber and charcoal production.

1.2 Principle aims

- To record the historic information about the Santaca family, Licuáti Forest and its utilisation by local population.
- To comply a checklist of vascular plants of Licuáti Thicket.
- To annotate the checklist by adding various attributes (biological and ecological), including common names, growth form (tree/shurb/climber, herb), life history (perennial, evergreen or deciduous), fruit type (fleshy or dry) and medicinal uses to the taxa included in the checklist.
- To establish the taxonomic identity of the species of *Xylopia* collected in the Licuáti Thicket.
- To use Landsat images and aerial photographs to verify the dynamics of the Licuáti Thicket and associated Licuáti Forest between 1958 and 1989.

1.3 Research questions

- How many MC endemic taxa occur at the Licuáti Thicket?
- How many woody plant species are found in the Licuáti Thicket?

- Is the *Xylopia* in the Licuáti Thicket conspecific with *X. torrei*?
- What size is the area covered by Licuáti Thicket?
- Which species in Licuáti Thicket do local communities use?
- Has the structure, distribution and size of the Licuáti Thicket been changed by timber and charcoal production?

1.4 Layout of the report

This report has been divided as follows. A Table of Contents (pp. ii–iii), and a List of Figures and Tables (p. iv) are followed by an Abstract (pp. 1–2) and a condensed Project Proposal (pp. 3–6). A General Introduction and Historical Background are given in Chapters 1 and 2 respectively. Chapter 3 contains the General Materials and Methods, while Chapters 4 and 5 are presented as two independent manuscripts, both compiled in the format required by the scientific journal *Bothalia*. Chapter 4 deals with the Licuáti Sand Thicket, and Chapter 5 with the taxonomic identity of *Xylopia torrei*. Appendix 1 is a Checklist of the Plants of the Licuáti Thicket, while several miscellaneous photographs, numbered from 1 to 25, are presented in Appendix 2. Numbers in the text that are in bold and between square brackets refer to the photographs contained in Appendix 2. A Summary of the report is provided on pp. 67–68 and mainly covers the information contained in Chapters 1, 2, 4 and 5. Acknowledgements, General References, and the Curriculum Vitae of the author are provided on pp. 69–78.

CHAPTER 1

GENERAL INTRODUCTION TO THE MAPUTALAND CENTRE OF ENDEMISM

1.1 Background

Historically, the name Maputaland has been applied, broadly speaking, to the coastal plain stretching from Maputo in Mozambique, southwards to near the Mkuzi River in northern KwaZulu-Natal (Bruton & Cooper 1980). The southern border of this region has in recent times been extended further south, to the estuary of Lake St Lucia, to include a greater part of a well-demarcated biogeographical region. Maputaland has previously been known as Tongaland—a name that has fallen into disuse among the local inhabitants, and which is no longer recommended (Van Wyk & Smith 2001).

In his classification of Africa into large phytogeographical regions or phytochoria, White (1983) included the area now known as Maputaland in his larger 'Tongaland-Pondoland Regional Mosaic'. Maputaland has also been considered a 'transition zone' between the northern tropical/subtropical flora and the southern temperate flora (Moll & White 1978; White 1983). This view of Maputaland as a 'mosaic' or 'transitional zone' long obscured the importance of Maputaland as a centre of endemism in its own right (Van Wyk & Smith 2001). When the World Wide Fund for Nature/International Conservation Union (WWF/IUCN) declared southern Mozambique and KwaZulu-Natal a 'Centre of Plant Endemism'in 1994 (Davis *et al.* 1994), the high levels of endemism—spread across the whole taxonomic spectrum, including both animals and plants—of the region were highlighted.

Van Wyk (1994) defined the boundaries of the Maputaland Centre of Plant Endemism [MC], and also provided information on the rich biodiversity of this centre (Van Wyk 1996).

1.2 Physical description

Topographically, the MC lies in a nearly flat, low-level coastal plain with a maximum elevation of about 150 m. Some extensive wetlands, including marshes, lakes and estuaries, occur within the centre.

The geology of the coastal plains consists mainly of Cretaceous to Recent marine sediments, with shallow marine, littoral and coastal dune deposits (comprising the Cenozoic Maputaland Group) representing a series of marine regressive events following marine transgressions (Botha 1997; Maud & Botha 2000).

The geological history of the region suggests that the current ecosystem in the area may be of recent derivation—a perception that is further exemplified by the fact that many of the endemic plant taxa occurring in the region comply with the concept of neoendemism. Neoendemism or neoendemic refer to those plant and animal taxa that occur in a restricted area and are considered to be newly derived or recently developed from earlier (possibly widespread) ancestors. This is opposed to the concept of palaeoendemism which can also refer to a taxon with a restricted global distribution, but in which case the taxon are considered the last remnant of an ancient taxon that is slowly dying out due to natural causes and which is slowly being confined to an increasingly shrinking area of distribution.

An area that is characterised by neoendemic taxa such as Maputaland can, in Africa, be considered a unique environment, as Africa is more usually considered a palaeo-environment (or mosaic of palaeo-environments) characterised by palaeoendemic taxa. This is because, geologically speaking, Africa is quite old, while Maputaland is geologically young, with biological evolution (notably speciation) still very active in the region (Siebert *et al.* 2002).

1.3 Climate

Maputaland lies within a transitional zone between the tropics to the north and the subtropical coastal conditions to the south. Summers are hot and winters cool to warm with no frost (mean temperatures: 16°C in July, 27°C in January). Schultze (1982) describes the climate of the region as warm to hot, humid and subtropical.

Annual rainfall averages about 1 100 mm along the coast, but progressively declines inland to as low as 500–600 mm on the western plains. Relative humidity is generally high on the plains, even away from the coast (Van Wyk & Smith 2001).

Climate plays a primary role in defining the vegetation of Maputaland. The east to west change in rainfall superimposed on the north to south and tropical to subtropical transition, together with an intimate relationship between geology, geomorphology and soils, has resulted in six main terrestrial ecozones being identified. The two easternmost ecozones—the coastal dune zone and the coastal lakes and wetland zone—developed in close relationship with the marine environment, with the dunes playing a major role in cutting off the estuaries from the sea, resulting in lakes that gradually becomes segmented to form wetlands (Siebert *et al.* 2002).

1.4 Flora and vegetation of Maputaland

1.4.1 Vegetation

The vegetation of Maputaland is very diverse and includes different types of grassland, bushveld, thicket, forest, and swamp vegetation. Two remarkable vegetation types, Sand Forest and Woody Grassland, are endemic to Maputaland (Moll 1977, 1980).

Maputaland is covered with woodland, with patches of short and tall forest usually bordered by grassland. Wild & Barbosa (1967) mapped the central area as dry, semi-deciduous

(lowland-sublitoral) forest, with woodland and savanna woodland (southeastern sublitoral) also occurring. The woodland and savanna woodland contain many extra-tropical species. Floristic composition alone is usually not enough to differentiate between the different types of woodland communities, and structure and density characteristics are usually used to help distinguish between them.

The woody grasslands of Maputaland, or 'the underground forests of Africa' as White (1967) liked to refer to them, are characterised by the many geoxylic (often rhizomatous) suffrutices that occur there. Geoxylic suffrutices, often referred to as 'underground' or 'stunted' trees, are dwarf woody plants with annual or short-lived woody shoots sprouting from massive or extensive woody, perennial, underground axes. Common examples of geoxylic suffrutices that occur in the grasslands of Maputaland are: *Ancylobotrys petersiana*, *Diospyros galpinii*, *Eugenia albanensis*, *E. capensis*, *Parinari capensis* subsp. *incohata* and *Salacia krausii*. The woody grasslands are also rich in plant species endemic to the MC (Lubbe 1997).

1.4.2 Flora and endemism

The fauna and flora of the MC are predominantly of Palaeotropical (Afrotropical) derivation, and Cape floristic elements are very rare among the endemics. Although palaeoendemics are present in the region, most of the Maputaland endemics appear to be of fairly recent derivation—a perception supported by the fact that some are differentiated at the infraspecific level only, with their nearest relatives still extant. The MC is therefore outstanding specifically for its richness in neoendemics; and biological evolution, including speciation, appears to be especially active amongst both the plants and the animals in the region (Van Wyk & Smith 2001).

At least 2 500 vascular plant species, of which at least 230 species/infraspecific taxa are endemic or near-endemic, occur within the MC (Van Wyk 1996; Van Wyk & Smith 2001). Three genera, namely *Brachychloa*, *Galpinia* and *Helichrysopsis* are endemic or near-endemic to Maputaland. The plant families Asclepiadaceae, Rubiaceae, Liliaceae,

Acanthaceae, Euphorbiaceae, and Asteraceae contribute the largest numbers of endemic taxa to the region.

Nearly all life forms and life history types (including saprophytes, hemiparasites, and monocarpic plants) are represented among the endemic taxa, but most of the endemics tend to be trees, shrubs, geoxylic suffrutices, lianas, forbs, geophytes and annual herbs (Van Wyk 1996). The presence of large numbers of annuals and short-lived perennials in Maputaland is noteworthy. In southern Africa, where most of the centres of endemism lie within areas that receive mainly summer rainfall, annuals are usually either rare or absent.

Most of the Maputaland endemics are associated with two plant communities. Forty-two endemic taxa are associated with Sand Forest (*Drypetes arguta-Uvaria lucida* subsp. *virens* forest), with 27 taxa being restricted to it, and 37 (13 restricted) are associated with the *Strychnos madagascariensis-Combretum molle* woodland matrix (Matthews *et al.* 1999).

The *Themedeto-Salacietum* woody grassland, which occur closer to the coast, is another plant community noted for its high number of MC-endemics, and 20 endemic/near-endemic taxa have been recorded from the *Spirostachys africana-Berchemia zeyheri* closed woodland, which occur on clay soils, and not on sand as most of the other plant communities in Maputaland.

Although many of the endemic plants have wide distributions within the MC, quite a number occur more locally. Some of the MC-endemics are restricted to the southern parts of Maputaland, while others are known only from the northern parts. A third group of endemics is largely confined to the Lebombo Mountains that more-or-less form the western border of the MC. Succulent endemism is largely confined to the genera *Aloe* and *Euphorbia*, and the tribe Stapelieae. Approximately 50 succulent taxa are endemic to Maputaland.

1.4.3 Forests of Maputaland

White (1983) classified the forests of southern Africa into two phytochoria, the Afromontane Archipelago Regional Centre of Endemism (which extends to the northeastern African uplands and then to West-Africa) and the Tongaland-Pondoland Mosaic (which is largely restricted to the eastern coastal belt of southern Africa). White's phytochoria were not mapped at a fine enough scale to separate the Sand Forest of northern KwaZulu-Natal and southern Mozambique from the other Tongaland-Pondoland vegetation types such as Coastal Forest (Matthews *et al.* 1999).

Low & Rebello (1996) divided the forests of southern Africa into three main types, namely Afromontane, Coastal and Sand Forest. Two of these, namely Coastal and Sand Forest occur within Maputaland, mosaics of which occur in some places closer to the coast. Long-vanished Coastal Forest might even be the ancient precursor of Sand Forest (W. Matthews pers. com.).

In many parts of Africa, the boundary between forest and adjacent vegetation types (usually grassland or woodland, and rarely fynbos) is very abrupt, and in nearly all cases the transition does not correspond to environmental discontinuities. The abruptness of the forest boundaries is usually ascribed to fire (Hopkins 1979; Midgley *et al.* 1997), an important determinant of forest edge species composition. Forest rarely burn—fires usually stop at the forest margin. In the case of the Sand Forest of Maputaland, not only does it have distinct boundaries, but it also has a narrow zone (1–3 m wide) of nearly bare soil around the edge. There are indications that these narrow bands of bare soil may be the result of allelopathic chemicals produced by Sand Forest species, which prevents the establishment of other plants immediately adjacent to the forest. This means that Sand Forest, through allelopathic means, possibly establishes a unique environment for itself that also results in specific grassland communities neighbouring the Sand Forest. The bare zone may also play a role in the protection of Sand Forest against fire, by acting as a kind of natural firebreak (Matthews *et al.* 2001).

In most parts of Africa, forests form mosaics with moist grassland and savanna (= woodland). Relictual patches of Afromontane and Coastal Forest may occasionally be associated with savanna, but this is usually when the site is a restricted refuge for the forest, and the type of savanna is usually more mesic. Sand Forest occurs mostly in a mosaic with dry savanna and thicket (Matthews *et al.* 2001).

1.4.4 Sand Forest

Sand Forest occurs under drier conditions than most other forest types, and is therefore classified as tropical dry forest. According to Marker & Russel (1984), the presence of mixed forest in the low rainfall areas of the Eastern Cape can partly be ascribed to the presence of fog and to the water holding capacity of the deep sands, which sustain forest growth. The Sand Forests of Maputaland are also found on deep sand, and periodically experience heavy mist, especially in winter. Mist capturing by Sand Forest species can greatly increase the quantity of available water within the forest community, and therefore probably plays a role in the maintenance of Sand Forest in the relatively dry areas they occur.

Research by Matthews *et al.* (2001) has shown that Sand Forest, when compared with Afromontane and Coastal Forest, is exceptionally rich in endemic species. These mainly neoendemic taxa are centred in the core area of the MC; that is the area south of Maputo-Quissico (Mozambique) and north of Lake St Lucia in northern KwaZulu-Natal (South Africa).

Sand Forest (as floristically defined) is, as far as we know, more-or-less confined to the MC. It tends to be patchily distributed within Maputaland in characteristic north-south oriented strips (Vahrmeijer 1966; Moll 1978a, 1980; Moll & White 1978; Ward 1981). Tinley (1971) mapped the distribution of a dry, semi-deciduous forest type (probably Sand Forest) as a thin zone stretching from northern KwaZulu-Natal up to Quissico (approximately 100 km south of Inhambane) in Mozambique. The northern limit (from Maputo-Quissico) of this dry semi-deciduous forest is still unclear, as Tinley noted a change in the species composition in the

area north of Maputo Bay.

The term Sand Forest has been used in general (e.g. Goodman 1990; Midgley *et al.* 1997) and popular (e.g. Pooley 1993; Craib 1995) writings. In South Africa, Sand Forest refers to dense forests with numerous trees and shrubs (De Moor *et al.* 1977; Moll & White 1978; Moll 1978b; 1980), with a relatively short canopy. Different heights have been defined for Sand Forest: 6 m or higher (De Moor *et al.* 1997), 10–25 m (Moll & White 1978; Moll 1978b, 1980), 5–13 m, and terming it 'emergent' when it reaches height of above 15 m (Ward 1981). Sand Forest occurs under fairly dry conditions, receiving an average of 600–1 000 mm (Tinley 1967), or more conservatively 700–900 mm (Moll & White 1978), of rain per year. It occurs on white to deep red soils (Vahrmeijer 1966; Tinley 1967; De Moor *et al.* 1977; Moll & White 1978; Moll 1978b, 1980; Ward 1981).

Sand Forest is best developed on the ancient north-south trending sand dunes of the coastal plain to which it is restricted in northern KwaZulu-Natal and the extreme south of Mozambique. Sand Forest is mainly evergreen, with a unique biological composition, including many MC plant and animal endemics (Van Wyk & Smith 2001). Because of its restricted occurrence and unusual species compliment, Sand Forest or Licuáti Forest is one of the most important plant communities in the MC (Matthews *et al.* 2001), and provides rich resources for sustainable rural livelihoods (Dutton & Dutton 2000).

Kirkwood & Midgley (1999) assessed the floristic uniqueness of the woody component of Sand Forest in relation to a range of other forest types in northern KwaZulu-Natal.

Characteristic woody species of Sand Forest include *Balanites maughamii, Cola greenwayi, Croton pseudopulchellus, Diallium schlechteri* **[18]**, *Drypetes arguta, Hyperacanthus microphyllus* **[23]**, *Newtonia hildebrandtii, Psydrax fragrantissima* **[17]**, *Pteleopsis myrtifolia, Ptaeroxylon obliquum, and Uvaria lucida* subsp. *virens.*

1.5 Forest Reserves in Mozambique

Forest reserves in Mozambique are included in protected areas and are defined as a delimited territorial area, which represents natural and national patrimony, and have the role of conserving the biodiversity and endangered ecosystems and the animal and plant species contained within.

Most of the Forest Reserves in Mozambique were established about 50 years ago during colonial rule, and the first objective was to protect woody species with an economical value. As part of the protected environment, the forest reserves were created to protect the vegetation types that contained species with commercial value and which were harvested intensively. The LFR, for instance, were created to protect the tree species *Afzelia quanzensis* **[25]** (or Chanfuta as it is known locally).

The conservation status of most of the Forest Reserves of Mozambique is low, as most of them are degraded due a high demand for, and exploitation of, woody species for fuel, wood and timber. Some, however, are still in pristine condition as they were protected and conserved by local communities for their cultural and traditional value.

Though Mozambican law makes provision for the protection of the forest reserves with three main laws, namely the Land Law, Environmental Law, and Forest and Wildlife Law, enforcement is very low, and additional measures had to be taken to control the exploitation of resources at the LFR.

1.6 The Licuáti Forest Reserve [LFR]

1.6.1 History and Location

The LFR is situated about 70 km south of Maputo, close to the South African and Swaziland borders. Locally it is referred to as Licuáti Forest and is also known as Sand Forest in South Africa. The major vegetation type of the reserve is Sand Forest. Licuáti Forest has many rare plant and animal species, and is classified as tropical dry forest.

The LFR was declared as such on 14 December 1943 by portaria 5354, to protect woody species, particularly *Afzelia quanzensis* **[25]** (Gomes e Sousa 1968). Although this reserve does not have well-defined boundaries, it is located between the Tembe and Maputo Rivers, and the Porte Henrique-Bela Vista, and Bela Vista-Catuane roads, at 26°20' S and 32°30' E. The reserve and surrounding areas cover about 40 000 ha (Mangue 1999). However, we doubt the ca 19 100 ha figure (for total area covered by forest) by Mangue (1999). The name LFR has been applied for convenience, since the name Licuáti refers to the dense stands of impenetrable Sand Forest, and not to the areas where most of the *Afzelia quanzensis* **[25]** is found.

In most households in Maputo, firewood has been replaced by charcoal as fuel of choice, mainly because of its higher energy density and because it is cheaper to transport. In parts of the forest where resources are still abundant, the process of charcoal production consists of felling selected tree species of selected sizes. Piles of logs are then covered by soil and burned. Trees, which are preferred for charcoal and firewood are *Acacia nigrescens, Albizia forbesii, Combretum hereroense, C. imberbe, Dichrostachys cinerea, Newtonia hildebrandtii* and *Terminalia sericea* (Mangue 1999).

1.6.2 Flora and Vegetation

The flora of Licuáti Forest is very diverse and includes typical sandveld species such as *Pteleopsis myrtifolia, Cleistanthus schlechteri* **[21]**, *Hymenocardia ulmoides* and *Monodora junodii*, which Van Rooyen *et al.* (1981) also recorded in sandveld thickets from the Punda Milia-Pafuri-Wambiya area in the Kruger National Park.

According to White (1980), the LFR is characterised by large numbers of species such as *Afzelia quanzensis* **[25]**, *Albizia forbesii, Dialium schlechteri* **[18]**, *Balanites maughamii, Spirostachys africana, Erythrophleum lasianthum, Hymenocardia ulmoides, Newtonia hildebrandtii, Terminalia sericea, Strychnos madagascariensis* and *S. spinosa*. These are all species that are typical in ecosystems where both water and nutrient availability control primary production. Such ecosystems are characterised by episodic rainfall, separated by dry periods (Mangue 1999).

Moll & White (1978) considered some of the typical Licuáti Forest species (such as *Balanites maughamii, Cleistanthus schlechteri* **[21]** and *Newtonia hildebrandtii*) to be Zanzibar-Inhambane linking species. (The Zanzibar-Inhambane Region is the coastal phytochorial mosaic extending from southern Mozambique to east Africa.).

According to Matthews *et al.* (2001), Midgley (1993) claimed that Licuáti Forest is dominated by species with wind-dispersed seeds, whereas other Indian Ocean Coastal Forests are dominated by fleshy-fruited species. From an analysis of unpublished data on the dispersal patterns in the Licuáti Forest of the Tembe Elephant Park in northern KwaZulu-Natal, it can now be shown that only about 5% of the species are definitely wind-dispersed. (This data applies to the more coastal Licuáti Forest types.)

Leaf attributes are generally fairly similar amongst all forest types. Licuáti Forest is no exception, with plants generally evergreen, non-spinous, and leaves predominantly simple, micro or mesophyllous and entire. Semi-deciduous species do occur in Licuáti Forest, but

these species are not dominant. Protruding crowns of many larger species are usually covered by epiphytes such as the wiry orchid *Microcoelia exilis* and various lichens including *Usnea* spp.

According to Van Wyk (1996), the MC houses 225 endemic plant species, 30 of which are associated with, and about 20 of which are restricted to, Licuáti Forest.

The LFR is also home to many medicinal plant species, including *Warburgia salutaris, Balanites maughamii, Tarenna species, Securidaca longipedunculata, Zanthoxylum species, Bridelia cathartica, Synaptolepis kirkii, Indigofera species, Xylotheca kraussiana, Acridocarpus natalitius* var. *linearifolius, Erythrophleum lasianthum, Brachylaena huillensis, Ochna* spp., *Garcinia livingstonei* and many others.

Traditional medicine is very popular, and more than 80 % of the people who live in the vicinity of the LFR use local knowledge about natural resources for their healthcare. Although the knowledge and use of medicinal plants are centred or dominated by traditional healers, it not restricted only to them. Every member of the community has a reasonable knowledge of first aid treatments, particular with regards to the most common diseases like diarrhoea, fevers, snake and insect bites. The forest is, however, highly valued by the traditional healers who collect most of the medicinal plants. Their knowledge is passed on in the family after their death by the means of the spirit or medium (Mangue 1999).

The utilisation and harvesting methods of the traditional healers are generally sustainable and follows the rules and regulations of the trade. Overexploitation of traditional medicinal plants is mostly the result of large scale commercialisation by urban vendors, a breakdown of taboos and the introduction of more efficient implements such as cane knives and metal axes with which to do the collecting (Cunningham 1997). The most common parts of plants collected are leaves, roots and bark.

Other valuable species in the LFR are timber species such as *Afzelia quanzensis* **[25]**,

Newtonia hildebrandtii and *Terminalia sericea*. Local houses are mostly built using products from the forest, grassland and riverine vegetation. The harvest of trees and shrubs for construction are usually selective, with durability and insect resistance two of the most important characteristics for selection. The preferred species for standing poles, and lattice and roofing structures are *Terminalia sericea, Pteleopsis myrtifolia, Antidesma venosum, Croton pseudopulchellus, Brachylaena discolor, Balanites maughamii, Hymenocardia ulmoides, Sapium integerrimum, Gardenia volkensii, Monodora junodii,* and *Uvaria lucida*. Walls are covered with *Phragmites australis* or *Typha capensis*. The most preferred thatching material are obtained from the grasses *Cymbopogon excavatus, Imperata cylindrica* and *Hyperthelia dissoluta* (Mangue 1999).

1.7 SABONET expedition

As part of a Southern African Botanical Diversity Network (SABONET) initiative, a regional expedition to the MC was conducted from 23 November to 12 December 2001. Ponta do Ouro, the Maputo Elephant Reserve and the LFR where among the localities visited.

The broad objective of this regional expedition was to gather additional data on the botanical diversity of southern Mozambique for use in future projects that are related to initiatives such as transfrontier parks, sustainable medicinal plant harvesting, ecotourism, and rural development, by local botanical institutions.

There is a great scarcity of basic data within the fields of biodiversity and conservation in Mozambique, and basic assessments of the flora of Mozambique will greatly benefit the region. At the moment it is a huge disadvantage that so little sufficient floristic data are available that can serve as a background for the establishment of proper management plans and the monitoring of developmental activities. The area is also one of the few places in sub-Saharan Africa where evolutionary processes such as active speciation and the establishment of plant communities within young ecosystems can still be studied (Siebert *et al.* 2001). The baseline data obtained during this expedition will be of immense value to the end-users of

botanical information in both Mozambique and the rest of southern Africa.

Regional and local experts who assessed the floristic richness and level of endemism of the area provided baseline floristic data for the LFR. The assessment was done in many parts of the forest officially known as the LFR. The reason why I chose to carry on with a study of the LFR was because I wanted to understand the existence of the short Sand Thicket more-or-less at the middle of the reserve, its specific composition, level of endemism, the dynamics, utilisation and the conservation of this ecosystem.

1.7.1 New record of *Xylopia species*

The first record of a *Xylopia* sp. at the LFR was made during the SABONET Mozambique Expedition of December 2001. Until then, this genus was only recorded from Nampula, Zambézia and Gaza provinces.

After some studies, including macromorphology, anatomy, and SEM-investigations at the University of Pretoria, and comparative studies of the holotype and other specimens from the LMA, LMU, PRE, and PRU herbaria, it was established that the species at LFR is *Xylopia torrei* **[12,13,14]**, which has previously only been recorded from Chibuto (Gaza Province). The research conducted on this species will be reported elsewhere.

CHAPTER 2
HISTORICAL BACKGROUND

2.1 General

The LFR is situated in the Matutuine District in Maputo Province, Mozambique. Matutuine has a population of nearly 36 000 inhabitants (INE 1997), and the population growth rate is estimated at about 2.7 %. Only one ethnic group, the Ronga, inhabits the Matutuine District, but most of them are also fluent in Chizinguiri (a variant of Ronga), and Zulu (Mangue 1999). The capital of Matutuine is Bela Vista.

The region where the LFR is situated is called Tinonganine and consists of six main areas: Tinonganine, Djabula, Xihatho, Santaca, Tanga, and Ncuvana. The total population of Tinonganine is approximately 3 927 (INE 1997). The village of Tinonganine, where Mr Augusto Carmone Santaca (acting chief of the area) and his relatives and family lives, is the main village in the Tinonganine area. Most of the people from Tinonganine and its surrounds are dependant on agriculture for their subsistence and survival.

The Licuáti ecosystem caters to all the needs of the local communities. It provides land for farming, timber and other building materials, wild fruit and vegetables, medicine, fuel wood, fodder and household commodities. Natural services such as nutrient cycling, the creation and maintenance of soils, acting as a source of pollinators, contributing to the regulation of the local climate, and providing sound habitat for the local communities are some of the less directly noticeable contributions of the Licuáti. It is further also a source of cultural symbols and sacred sites (Mangue 1999).

2.2 The Santaca family

The first king of Matutuine was Uangobe Tembe who lived in Kapizulu (also known as Uangobe). He had three sons called Tembe, Panhela and Maputo (all carried their father's

surname, Tembe). Tembe was in charge of the Catembe area and Panhela of the Namaacha and Changalane areas. In later years, Panhela took over a part of Swaziland and called it Dhlamini because he acquired it in the day (dhlamini means 'eat during the day' in Mswati). Panhela then changed his surname from Tembe to Dhlamini, and his sons also adopted the Dhlamini surname. Nowadays, the Swazi's do not even know that they are related to the Tembe family.

King Uangobe Tembe stayed in Kapizulu with his youngest son Maputo. After his farther passed away, Maputo took over the responsibility of Uangobe, and was crowned King of Matutuine (Catuane, Machangulo, Inhaca, Catembe, and some other areas). The new king renamed his land and called it Maputo. Although Maputo was the youngest of the three brothers, his political power was much stronger than either Tembe's or Panhela's. Maputo moved from Kapizulu to the Salamanga area, also called Madlhadlhane. Maputo had many sons, of which the most renowned were Salamanga and Makasane. The Matutuine area was renamed as Tembe, after the family name, but later became known under its original name again.

Makasane, one of the sons of Maputo, had two children, a son called Muwai, and a daughter called Diwandinwa. Muwai took two wives, and had three sons; Musongue and Ngohika from the first wife, and Makasanhe from the second. Muwai named his third son after his father, Makasane, but out of respect for his father, he altered it to Makasan(h)e. Muwai passed away before his own father, and did not get the opportunity to rule the land.

When his grandfather Makasane died, Musongue became king. Musongue's mother's labola included large herds of cattle, which made her and her family very respected among the local people. This made Musongue a very important person, and a suitable heir. He got married and had one son, Gwanaze. His brother, Ngohika, also had a son—Santaca I.

When the Portuguese arrived in Mozambique, Gwanaze ran away to South Africa where he resettled close to the border with Mozambique in the area then called Manguzi, now

Gwanaze. Gwanaze took responsibility for the area close to Ponto do Ouro on the South African side. A member of the Madlhadlhane family, Powowo, took over from Gwanaze, and became the Chief of the area.

Since Gwanaze had fled from Mozambique, Santaca I (son of Ngohika) became the new ruler. Santaca I had no sons, and when he passed away, the power had to be passed to one of his sisters' sons. Santaca, son of Ngohika, had two sisters; the oldest only had two daughters, but the youngest had three sons, including Santaca II, the father of the current Acting Chief Augusto Santaca and his brothers. Santaca II was a teacher and a medical assistant, the first of both professions in the Santaca area, and was well respected there.

During the colonial regime, Santaca II adopted the name Jorge Oliveira Santaca, and when he became chief of the area, his mother received a large labola of cattle, which made them well respected among the local people, and therefore, even though he was not the son of a chief, he became the new chief of the region.

After Mozambique gained independence from colonial rule, the traditional power was no longer recognised, and Jorge Santaca moved to South Africa where he stayed until his death in November 2001. He left behind three wives and many sons. They live in both Mozambique and South Africa, close to the border between these two countries. Jorge Santaca's body was burned in the Sacred Forest (see discussion below). Two sons from Mozambique, Chief Augusto and his brother Edmundo Santaca, attended the funeral of Jorge Santaca. They are planning to move all their family in South Africa back to Mozambique to choose the new chief. The new chief will be one of the brothers of Santaca II. If the chosen brother declines the chiefdom, one of the sons could take over by family consensus. There are eight brothers, two staying in Tinonganine, one in Chimoio, two in Maputo, and three in South Africa. All must be present at the family meeting before a new chief can be chosen, as the government of Mozambique has now recognised traditional power in the country.

Mr. Augusto Carmone Santaca is presently the acting chief of the area where part of the

Licuáti Forest is situated, and is also the Secretary of the Frelimo Party, by Frelimo nomination.

2.3 Interviews with Chief Santaca (Conducted by author on 10 October 2002)

When I did my fieldwork at the LFR, I stayed at Tinonganine and had a great opportunity to interview the chief and his youngest brother, Mr. Edmundo Tiófilo Santaca. Chief Augusto Carmone Santaca was born in the area called Santaca and is 62 years old. He has been a driver and mechanic for most of his life, but is presently a farmer. He was involved with the Blanchard project, working at the Maputo Elefante Reserve. In 2000 he worked at the Fabrica de Cimentos de Moçambique.

Mr. Edmundo Santaca was also born in Santaca, and is 55 years old. He has been a farmer since 1968, and had a small grocery shop in Tinonganine village, which he had to close during the war. He returned to his original profession after the war.

The LFR lies within the boundaries of the land controlled by Chief Santaca and his family, who therefore know a lot about the natural and cultural history of the area. According to Chief Santaca, the name LFR was applied only for the sake of convenience, as the name Licuáti refers to Sand Thicket, where very few *Afzelia quanzensis* **[25]** (Chanfuta) are found.

There are no official boundaries for the LFR, but to protect Chanfuta, it is necessary that new boundaries for the reserve be defined—boundaries that exclude the Licuáti Thicket, and specifically protect the areas where Chanfuta is found.

The chief and his brother claims that the elephants and other big game that belong to the Maputo Elephant Reserve migrated long ago from the Licuáti Thicket to area in which this reserve is now located. They believe, that, in order to develop and expand the ecotourism potential of the LFR, it is necessary that the government reintroduce some animals that used to occur there, e.g. jackal, impala, kudu and other game, to the reserve. It is also important

that the habitats of the bird species that are endemic to the region be conserved.

Staff from the Ministry of Agriculture and Rural Development put pole fences around the thicket section of the LFR to mark the areas of different Ndunas or 'regulados'. This work was terminated even before the war. Most of these areas belong to the Santaca family, but within the boundaries of the bigger area, there are smaller areas that belong to different Ndunas. The fenced area demarcates the boundary between Kwane and Djabula.

2.4 Medicinal Plants

The use of traditional medicine is very popular within the area, and many local people have a good working knowledge about local medicinal plants. The people can collect medicinal plants from the forests without consulting with a traditional healer. Knowledge has been passed down over many generations and is used to cure almost all of the diseases commonly occurring in the area. The ordinary people do consult traditional healers when the symptoms persist or when they believe that the diseases are linked to spiritual problems. It is believed that the traditional healer has the power to cast out the disease-causing spirits and to prescribe medicine for the patient. To the local communities, the traditional healer is a medical doctor and spiritual leader all in one, someone who can cure them from all sicknesses and diseases.

Both tall forest and Licuáti Thicket are very important sources of medicinal plants. Tall forest, however, is the part that is subjected to the most use. As a result, the Licuáti Thicket is not under much pressure from medicinal plant collectors.

2.5 The Sacred Forest

The Sacred Forest was the home of the first chief and is now the cemetery of the Santaca family. The fact that this part of the forest has this special status, and the protection that goes with it, has resulted in the conservation of some important species that occur in the area. The local community has respect for this forest, and are not allowed to enter it without permission

from the Chief.

The Sacred Forest is also the site where the Santaca family asks for rain, good harvests and good luck for the community. This is known as the Marula Ceremony, and marula wine is made and prayers for a prosperous year are prayed. Chief Santaca wants to open up the Sacred Forest for ecotourism purposes, as he believes that all traditional ceremonies should be done and known by all visitors. 'Everyone who is interested to know us and to understand our culture should know the history', says the Chief.

I had the opportunity to attend a traditional ceremony where the Chief's brother presented a chicken and wine to introduce us to their ancestors. They believe that the ancestors should be informed about all visitors to the Santaca area, and about the objective of such a visit, to ensure good luck and smooth working operations.

2.6 Utilisation

Chief Santaca indicated that the areas of the reserve that is subject to the most use is those parts where most of the *Afzelia quanzensis* **[25]** and other woody plants such as *Combretum* spp., *Terminalia sericea, Sclerocarya caffra, Albizia species, Newtonia hildebrantii, Ekebergia capensis, Acacia* spp. etc.—i.e. the tall forest and woodland—occur.

Outsiders, mainly from Maputo, have also utilised these parts of the forest, mainly to exploit *Afzelia quanzensis* **[25]** (Chanfuta). The harvesters from Maputo return there via Goba, as they are well aware of the fact that the Directorate of Forestry and Wild Life check all vehicles for illegal timber at Porto Henrique. They return via Moamba roads to avoid this enforcement. The local communities mainly use the tall forest to selectively collect building material and firewood.

During the colonial times, law enforcement was very effective, and the local community was involved via the chief of the area. The Forest Reserve was placed under the protection and

control of the local chief, and he had to be consulted before any trees could be harvested. The chief was authorised to allocate trees and would then inform the government of the allowed areas and quantities of wood that can be harvested. Nowadays, the lack of law enforcement, together with a decrease in the local chief's authority, has resulted in the exploitation and overutilisation of the forest as the demand for timber increased. An attempt has been made by Chief Santaca to regain some control of the forest and the harvesting. The local communities now inform the chief when they find evidence of unauthorised timber cutting and charcoal production. The chief then informs the Department of Agriculture and Rural Development in Bela Vista, who then send officials to confront the illegal harvesters and apply a penalty according to the wood or charcoal quantity, and the product is confiscated.

The LFR is also used for hunting. Hunters have been known to use fire to try driving the game out of the forests, but this strategy mostly failed, as the animals tend to run deeper into the thicket. Local hunters have been advised to stop this practice because the destruction of many useful plants (e.g. medicinal or edible plants) by the fires. The fire is also dangerous for the people who live close to the forest. The local hunters now use traditional traps, namely holes covered with grass or snares. The animals fall into the traps or catch their heads in the nooses, and the hunters then come by later to kill them.

The local communities also use parts of the reserve to grow crops and build their houses.

2.7 Economic and social development

During colonial times, until the start of the war, the main economic activities of the local people were stock farming and growing crops. This was called 'Junta do Povoamento' (a project created by the Directorate of Agriculture of Lourenço Marques during colonial times). The main objective of this project was to network all the farmers so that they work collectively, and 5 ha were allocated to the local people for every 10 ha allocated to the community.

All equipment was shared and donated by the Project. It was used in benefit of all the farmers. As a result, all farmers could produce several crops, and surplus harvests were sold at the markets in Maputo. In this way, the local people had enough food and some money for other expenses.

Each farmer also received five cows from the Project. Surplus milk was also sold at the markets of Maputo. Veterinary Services, which also inspected the livestock, provided a vehicle to transport the milk to Maputo.

Currently, the local rural people face many difficulties. They no longer have their own farms, and they don't own any livestock. The quality of their lives has gone down since 'Junta do Povoamento', and they suffer from hunger, and lack basic facilities such as health care, educational facilities, and clean water. As a top priority, the people would like to see the good things of the past return so that everyone can again live in dignity and health, in a community where all benefit from communal farming efforts.

Only one school currently operates at Tinonganine, and the children have to walk long distances to get there. This school offers only basic education (primary school up to grade 5). The people would like to see more schools in other locations such as Santaca and Djabula, to minimise the problem. Most of the kids of the area do not proceed past primary school, as their parents do not have the funds to send them to other schools in Bela Vista, Salamanga, Boane or Maputo. The schools in Salamanga and Bela Vista in any case offer education only up to grade 7, which make them still only primary schools. The local communities would like to have some secondary schools in the area so that their children can progress further in their education. They would also like to see more teachers and equipment at the schools.

During colonial times, a medical doctor from Maputo came to visit once a week, and one medical assistant has permanently been on standby with all the medicines and medications. Now there is only one small clinic, with no doctor, and most of the time, without any medications. There is only one sanitary worker who visits once a week. In case of sickness,

the people have to seek private transport to Bela Vista or Maputo to see the doctor. As there is most of the time no transport available, people have to walk with the sick person to Bela Vista.

Public telephones and mail services were available during colonial times, but this infrastructure was destroyed during the war. Now, people have to travel to Bela Vista whenever someone has to make an urgent telephone call. Communication with the outside world is very difficult, and the people hope that this situation would improve in the future. There also is no electricity.

Mr Edmundo Santaca was informed that there was plans to built a dam on the Xuxa and Madiwa rivers in order to divert the water to Tembe River. This could avoid floods which damage crops, and this project is therefore very important for all the communities, as they will not only benefit from the dammed water during dry seasons, but they and their livelihoods would also not be threatened by the flooding of the Maputo river during the wet seasons. We would like to urge the government of Mozambique to proceed with this project.

CHAPTER 3
MATERIAL & METHODS

Though summaries of the materials and methods used in the investigations are provided in the chapters written up as articles according to the format and specifications of *Bothalia* (Chapters 4 & 5), a more complete description of each of the methods are provided in this chapter. Where applicable, complete references to the original accounts of the methods are given. Descriptions of the methods used are presented under headings referring to the various sources of evidence (leaf anatomy, SEM work, etc.) that were investigated.

3.1 Visit to the study area

A visit to the study area was planned and executed to meet and inform the local authorities in the area (Tinonganine and surrounds), as well as the administrative authorities in Bela Vista, about the study we were planning to conduct, its objectives and expected outcomes.

To get to know and to define the boundaries of the study area—namely the Licuáti Thicket, a literature review (including reports and Flora's) were done. Landsat images was obtained and used to define and demarcate the specific areas within the Licuáti Forest Reserve that was to be used in comparative studies.

The core area of this study is called the Sand or Licuáti Thicket, a very close and impenetrable vegetation type in more-or-less the centre of the LFR.

3.2 Fieldwork

A collecting trip to the Licuáti Thicket, LFR (26 20' S and 32 30' E), to collect plant specimens was undertaken. Specimens were collected, pressed, dried, mounted, and sent to the H.G.W.J. Schweickerdt Herbarium (PRU), University of Pretoria, for final identification.

Some of the leaves of the new record of *Xylopia* spp. we found in the Thicket were placed immediately in formalin-acetic-acid-alcohol (FAA), for anatomical and morphological studies.

3.3 Herbarium studies

To gain clarification on the identity of some of the species collected at the Licuáti Thicket, a herbarium study was carried out using the *Flora Zambesiaca*, *Flora de Moçambique, Flora of Southern Africa*, dichotomous keys and scientifically updated specimens at the National Herbarium, Pretoria (PRE), the H.G.W.J. Schweickerdt Herbarium (PRU), and the LMA and LMU Herbaria in Maputo, Mozambique. Leaves of *Xylopia parviflora, X. odoratissima* and *X. tomentosa*, were collected from voucher specimens of different collectors from Mozambique, South Africa, Zambia and Zimbabwe.

One leaf of each species was rehidrated and placed in FAA for anatomical studies, while another was saved for further macromorphological studies using Scanning Electron Microscope (SEM) technology. The same was done with *Xylopia sp.*, collected in Licuáti Thicket.

3.4 Checklist of the Licuáti Thicket

An annotated checklist of the plants of the Licuáti Thicket was compiled using the specimens collected, preexisting checklists, and plant collections in the LMA, LMU, PRU and PRE Herbaria. Flora's, monographs and other relevant literature were also consulted in the construction of the checklist. Selected characteristics, such as growth form, fruit type, duration of flowering, endemic status, and medicinal usage were added to the checklist.

3.5 Dynamics of the Licuáti Thicket

The dynamics of the Licuáti Sand Thicket was verified by comparing aerial photographs

taken in 1958, 1982, and 1989, to study the changes in the structure of the vegetation over a period of 30 years. Maps showing the Licuáti Forest, and a topographic map were also used in the study. The coordinates that were taken during the collection trip were used to map the Licuáti Thicket. The map was produced using the GIS program ArcView.

3.6 Historical information and current utilisation of the Licuáti Thicket

Interviews were conducted with Chief Augusto Santaca, his brother Mr Edmundo Santaca, and one traditional healer Mr Dinis Nguenha in the Tinonganine district to gather information on the historical and current utilisation of the Licuáti Thicket.

Interviewees were asked the following 12 questions:

- Where is the official boundary of the Licuáti Forest Reserve?
- What is the local name for the Licuáti Short Forest (Thicket)?
- Why is there a fence around part of this short Licuáti Forest?
- For what purposes and how do the local people use the tall and short Licuáti Forest respectively?
- What do the local people think of the felling of trees in the forest and thicket?
- Is there any law enforcement against illegal felling of trees, and does anyone give permission for this activity?
- Are there any penalties when illegal cutting of timber takes place?
- What are the local people's feelings about the Sand Thicket? Should it be conserved?
- What is the meaning of the Sacred Forest?
- Do they know that the Licuáti Short Forest (Thicket) of the Licuáti Forest Reserve occurs only in this area and that it is unique?
- Are there many people who use medicinal plants for their health care? Do they consult traditional healers before they go into the forest to harvest the medicinal plants?
- What are the main economic activities in the area, and what do they think about rural development initiatives?

3.7 Studies on Xylopia: *Leaf* Anatomy

The leaf anatomy of the Xylopia species found within the Licuáti Thicket of the Licuáti Forest Reserve was studied using light microscopy (LM). The material was prepared as follows:

3.7.1 Dehydration and imbedding of leaf material

(Adapted from Feder & O'Brien (1968))

Pieces of leaf lamina (3 mm x 3 mm) were cut from material fixed and preserved in FAA using a sharp razor blade. The pieces were cut to either include a part of the lamina between the midrib and the leaf margin, or to include midrib bordered by small parts of lamina. Pieces were cut ± 1/3 of the length of the leaf from the leaf base.

The pieces of leaf material were washed using 50% ethanol (EtOH), dehydrated using a graded alcohol series, and finally infiltrated with glycol methacrylate (GMA) *1:

2 x 10 minutes in 50% EtOH

2 x 30 minutes in 70% EtOH

2 x 3 hours in 96% EtOH

2 x 4 hours in 100% EtOH

2 x 4 hours in 100% propanol

2 x 4 hours in 100% butanol

2 x 15 days in GMA in a dark cabinet

After infiltration with GMA, the pieces of leaf material were transferred to marked gelatin capsules filled with new (clean) GMA.

Capsules were heated in an oven at 50°C until the GMA has been completely polymerised (after three to four days).

Ultra-thin section (± 4 µm) was made using a Leica 2045 ultra-microtome fitted with a glass knife.

Sections were mounted on microscope slides, double-stained with the periodic acid-Schiff's (PAS) reaction and toluidine blue*2, and viewed using a light microscope.

*1 The GMA monomer mixture was prepared according to the following recipe:

To prepare 200 ml of GMA

188 ml 2-hydroxyethyl methacrylate (HEMA, GMA) (Electron Microscopical Sciences, Cat. No. 16800, Premier Technologies)

12 ml polyethylene glycol 200

1.2 g benzoyl peroxide

The mixture was mixed very slowly with a magnetic agitator for one hour or longer until the catalyst (benzoyl peroxide) was completely dissolved. It was then filtrated using a Whatman No. 1 filter paper, and placed under a soft vacuum for approximately one hour.

*2 Staining of plant material using the PAS (periodic acid-Schiff's) reaction and toluidine blue:

Sections of plant material were stained as follows:

Microscope slides with uncovered sections were placed in a saturated solution of DNPH (2-4 dinitrophenylhidrasine)*3 for at least 30 minutes to neutralise the aldehydes present in the material from the FAA in which it was preserved and fixed.

After 30 minutes, the material was rinsed in flowing tap water for approximately 10 minutes. It was then placed in a 1% solution of periodic acid for exactly 10 minutes. (To prepare a fresh solution of periodic acid: dissolve 1 g of periodic acid in 100 ml distilled water.)

The material was rinsed for 5 minutes in flowing tap water after which the microscope slides were dried on a hot plate.

The microscope slides were placed in Schiff's reagent for 30 minutes after which they were again rinsed in flowing tap water for 5–10 minutes.

After a final rinse in distilled water, the material was stained in toluidine blue for 30 seconds, after which it was rinsed with flowing tap water until the surrounding material was clear.

The microscope slides were again dried on a hot plate, and the material mounted permanently with entallen.

*3 Preparation of DNPH solutions:

To make up a 200 ml solution of saturated DNPH:

0.6 g–1.0 g DNPH

30 ml acetic acid

170 ml distilled water

Mix ingredients with a magnetic agitator (for several hours, or even overnight) until a saturated solution of DNPH has formed. Filtrate mixture with a Whatman No. 1 filter paper to get rid of excess, non-dissolved, DNPH.

3.8 Leaf macromorphology (SEM studies)

Pieces of dried leaf material (3 mm x 3 mm) of *Xylopia torrei [12,13,14]*, *X. parviflora*, *X. odoratissima* and *X. tomentosa*, were mounted on SEM buttons with plastic bands and liquid silver. After being sputter-coated with gold, the SEM buttons with gold plated samples were loaded into a JEOL 640 SEM to study the differences between the leaf surfaces of the five species.

CHAPTER 4

THE LICUÁTI SAND THICKET: A UNIQUE VEGETATION TYPE OF SOUTHERN MOZAMBIQUE*

*Manuscript follows format of *Bothalia*

Licuáti Sand Thicket: A unique vegetation type from southern Mozambique

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KEYWORDS: Ecology, endemism, ethnobotany, flora, indigenous knowledge systems, Licuáti Thicket, Mozambique, Sand Forest, vegetation structure.

ABSTRACT

Licuáti Forest (usually referred to as Sand Forest in South Africa) is a very distinctive vegetation type, not only because of its unique combination of rare and endemic species, but also because it has a restricted global distribution. This dry tropical type of forest only occurs in southern Mozambique and northern KwaZulu-Natal, South Africa, where it is best developed on the ancient north-south trending dune cordons of the coastal plain of Maputaland. It is also one of the most important plant communities of the Maputaland Centre of Plant Endemism. Previously a distinction has been made between so-called tall and short Sand (Licuáti) Forest. Because of its vegetation structure, floristic composition, and high levels of endemism, and based on Edwards' structural classification of vegetation, we propose the name Licuáti Thicket for the short, dense form of short Sand Forest that covers about 14 000 ha in the Licuáti Forest Reserve, southern Mozambique. The aim of this study was to gather information on the floristic composition, utilisation and conservation of Licuáti Thicket that will aid in the development of a vegetation dynamics model that, in turn, can be used to guide reserve management, land-use planning, and sustainable utilisation programmes to conserve this rich, endemic vegetation type for future generations. This will only be effective if the indigenous knowledge systems of the area is incorporated and used in conjunction with official law enforcement.

INTRODUCTION

There exists, within the boundaries of the Maputaland Centre of Endemism [MC] (Van Wyk & Smith 2001), a vegetation type unique to this region, usually called Sand Forest in South Africa and Licuáti Forest in Mozambique. Up to now, no formal distinction was made between what was informally called 'short Sand Forest' and 'tall Sand Forest', or 'short Licuáti Forest' and 'tall Licuáti Forest'. After a close investigation of the short Licuáti Forest (or what we would like to call 'Sand Thicket') of the Licuáti Forest Reserve [LFR] in Mozambique (Figure 1), it was decided that this particular vegetation type is structurally clearly a thicket, not a forest, and therefore merits a classification separate from tall Sand or Licuáti Forest.

In his structural classification of vegetation, Edwards (1983) used specific combinations of growth form, cover and height attributes to distinguish among different vegetation types. He defined thicket as 10% tree cover with a 5–10 m height, and/or shrub cover with a height of 2–5 m. The dense thicket of the study area, the LFR in southern Mozambique, corresponds closely with this definition, and it is therefore justified to differentiate between Licuáti Forest and Licuáti Thicket. To further justify this separate classification of two vegetation types where up to now only one vegetation type, but with two height classes, were recognised, interviews were held with the local inhabitants, specifically with the prominent family of the region as represented by Acting Chief Augusto Carmone Santaca and his brother Edmundo Tiófilo Santaca. According to the Santaca brothers (ages 62 and 55, respectively), the Licuáti Thicket has looked like it does today since the time that they were children. They grew up in the area and often played in the Licuáti Thicket, and have never seen any tall trees in that area of the reserve. They say that the Licuáti Thicket has always been unique, and that it only occurs in a specific part of the region, and does not have the structure it has as a result of over harvesting of tall trees. Rather, the Licuáti Thicket has grown and established itself there with the characteristics it has today.

The boundaries of the Licuáti Thicket **[9]**, are Manhihane, which belongs to Djabula Nduna, and Maduvula, which belongs to Catuane Nduna. The Djabula Nduna is part of the Santaca

tribe, while Catuane is part of the Kapizulu tribe. A small part of Kwane, and ca. 2 km of Poxane also form part of the Licuáti Thicket. Most of the LFR is part of Djabula, and is therefore under the control of the Santaca family. Licuáti means 'very dense and impenetrable thicket' in the Ronga language, and the name is used to refer to the 'short forest' or thicket. The study area's thicket vegetation is the real Licuáti, and not the whole Forest Reserve, even though the LFR was proclaimed to protect *Afzelia quanzensis* (known locally as Chanfuta), which mostly does not occur in the Sand Thicket (the real 'Licuáti'), but rather in the surrounding Sand Forest (also called Licuáti Forest).

The two main patches of thicket within the LFR together covers about 14 000 ha (Figure 2), and contain many MC endemics/near-endemics such as *Strophanthus luteolus, Secamone delagoensis, Dovyalis longispina, Acridocarpus natalitius* var. *linearifolius, Combretum mkuzense* **[15]**, *Croton steenkampianus, Erytroxylum delagoensis, Ochna barbosae* **[24]**, and medicinal plants such as *Manilkara discolor, Landolphia kirkii, Synaptolepis kirkii, Oxyanthus latifolius* **[22]**, *Ochna natalitia, Psidrax locuples* **[16]**, *Croton pseudopulchellus, and Cassytha filiformis*. These endemic and medicinal plants that occur within the thicket are well protected, as most of the local people collect medicinal plants in the surrounding parts of the LFR, where species such as *Afzelia quanzensis* **[25]**, *Newtonia hildebrandtii, Balanites maughami, Combretum mkuzense* **[15]**, and other forest trees, occur. In contrast to the Licuáti Forest, the Licuáti Thicket contains few of these species, and then only in relatively small numbers, giving even more impetus to the decision to differentiate between Licuáti Forest and Thicket, as it alludes to a difference in the floristic composition of the two vegetation types.

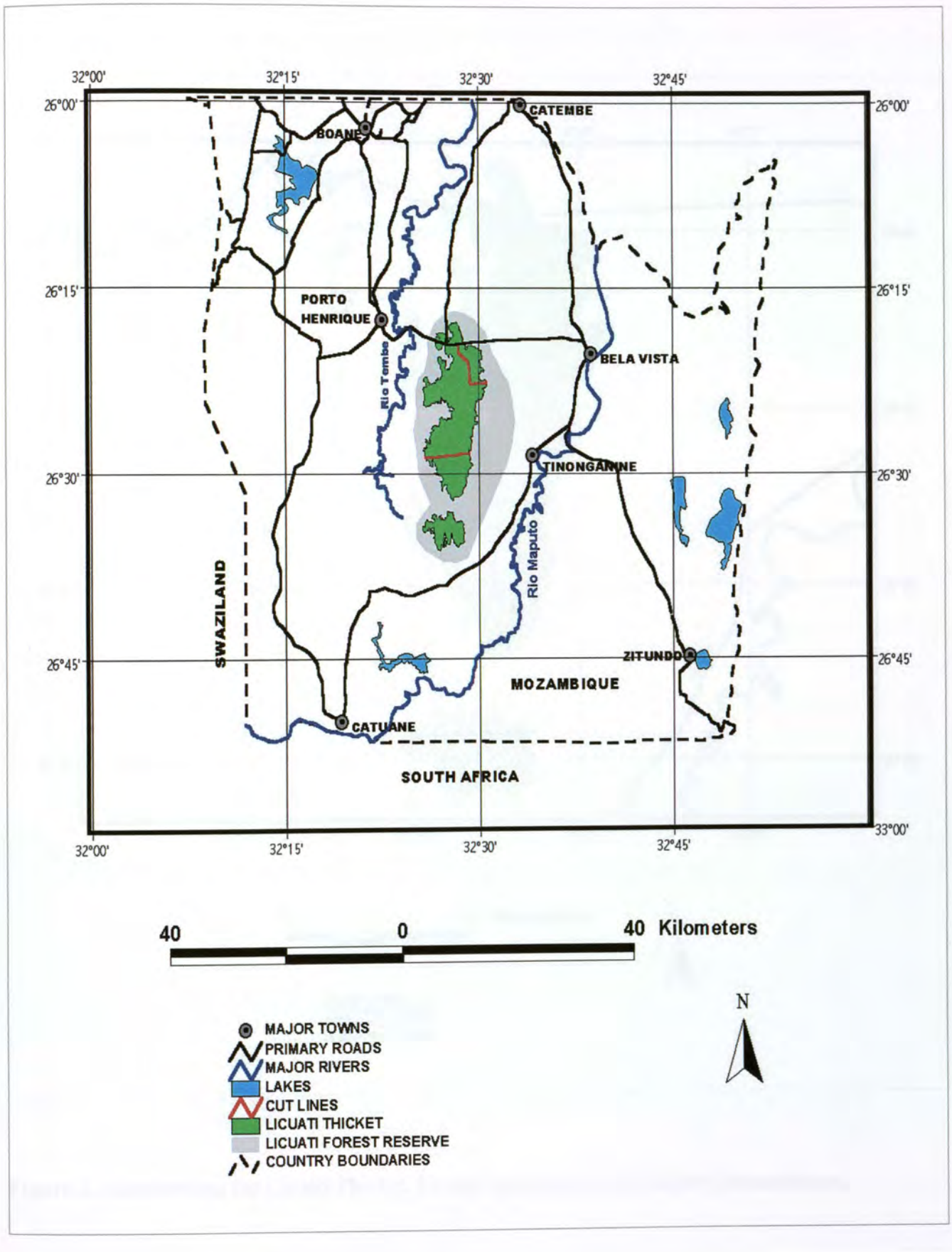

Figure 1. Map showing the location of the Licuáti Forest Reserve (LFR), southern Mozambique.

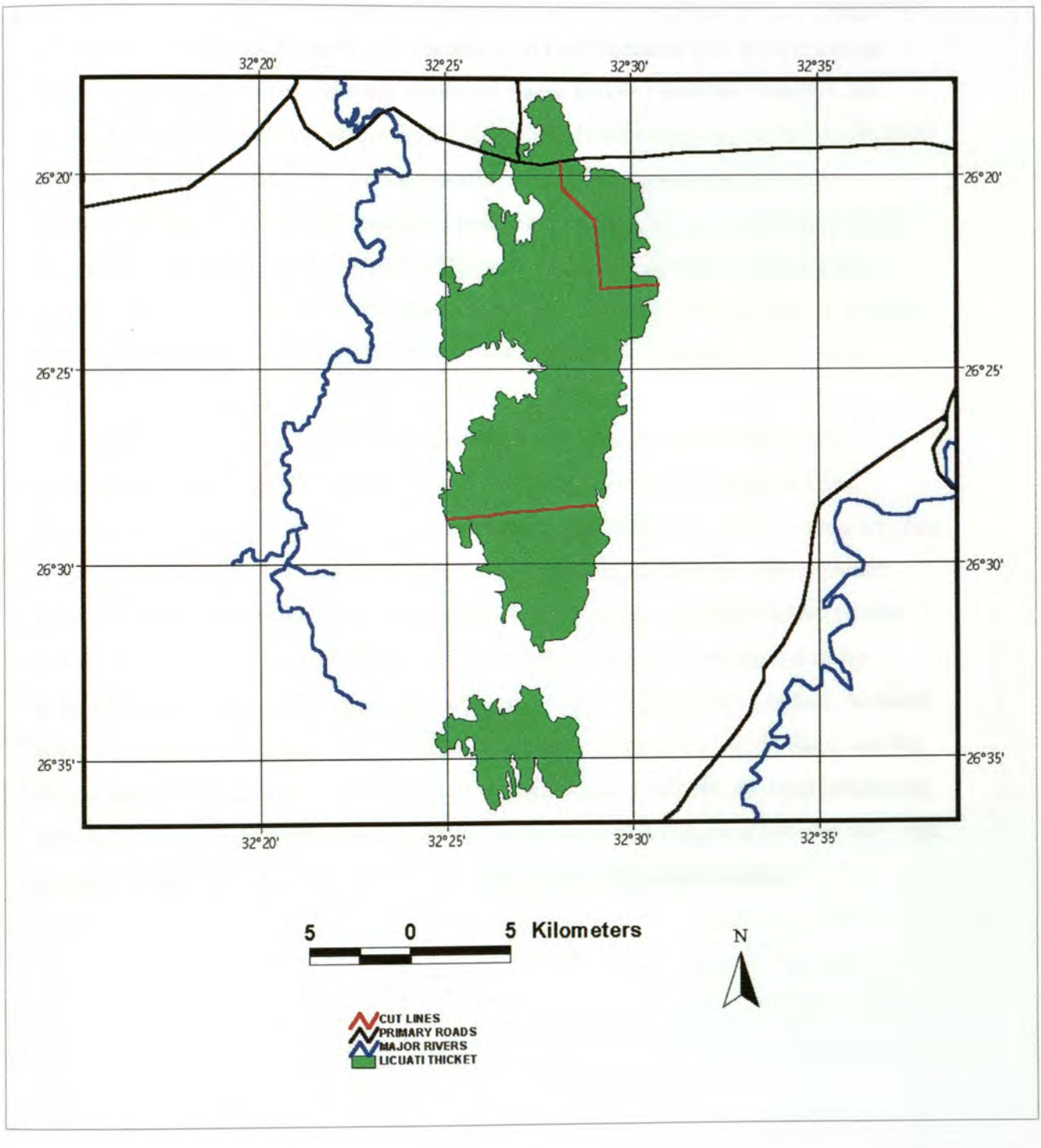

Figure 2. Map showing the Licuáti Thicket, Licuáti Forest Reserve, southern Mozambique.

The Licuáti Thicket is also home to many small mammals, birds and insects, some of which are endemic to the Maputaland region. Although the protection of the Licuáti Thicket has not been a priority to the local people, the importance of this vegetation type is slowly being realised. The thicket do provide some medicinal plants, building material, firewood and honey, but the locals prefer to utilise the tall forest, as it is not only closer to their homes, but also easier to enter, and to collect resources and hunt in. The thicket is much more impenetrable than the forest and therefore more of a hindrance than a help during everyday activities such as those mentioned above. Due to its inaccessibility, the thicket acts as a natural refuge for small wildlife, therefore not only contributing to the protection of endemic and medicinal plants, but also to the conservation of these small animals.

Chief Santaca said that he would like to see the Licuáti Thicket preserved for future generations. He also said that this part of the LFR has always been the same, and that, although the local people do not know about its uniqueness and high levels of endemism, they have always had a lot of respect for this area. Now that Chief Santaca has been informed about the richness and uniqueness of the Licuáti, he has become sensitised and has agreed that the area should not be exploited beyond its endurance, but rather be opened up for ecotourism, which is less destructive than many other of the possible uses to which the forest and thicket can be put. Santaca believes that many people in the world would like to see this unique vegetation type with its endemic flora and fauna, and he felt that the local community was lucky to have inadvertently conserved the Licuáti for such a long time, and that they were fortunate to have all that richness and beauty right there in the Santaca district.

MATERIAL AND METHODS

Checklist of the flora of the Licuáti Thicket

An annotated checklist (Appendix 1) of the plants of the Licuáti Thicket has been compiled.

Characteristics such as growth form, fruit type, duration, endemic status, common name, and medicinal uses have been included in the checklist. Voucher specimens were collected, and all local common names and medicinal uses, given by a traditional healer in the area, Mr Dinis Nguenha, were noted. Voucher specimens are housed in the H.G.W.J. Schweikerdt Herbarium (PRU) of the University of Pretoria.

Dynamics of the Licuáti Thicket

The dynamics of the Licuáti Thicket was verified by examining aerial photographs taken in 1958, 1982, and 1989, to gain an understanding of the changes in the structure of the vegetation over a period of about 30 years. Maps of the Licuáti Forest and Licuáti Thicket respectively, were produced using the GIS program ArcView, and Landsat images for the area, supplemented by 1:50 000 topographic maps.

Historical information and present utilisation of the Licuáti Sand Thicket

To gather information about the historical and current utilisation of the Licuáti Thicket, interviews were held with the acting chief of the area, Mr Augusto Carmone Santaca, his brother Mr Edmundo Tiófilo Santaca, and with one of the traditional healers that operates around the village of Tinonganine and the Licuáti Forest Reserve, Mr Dinis Nguenha.

RESULTS AND DISCUSSION

Floristics of the Licuáti Thicket, Licuáti Forest, and the greater MC

The vascular plant flora of the Licuáti Thicket comprises about 113 indigenous species (Table 1) and makes up over 51% of the vascular plant diversity in the Licuáti Forest Reserve, which contain, in addition to Licuáti Thicket, also Licuáti Forest vegetation. Previously a total number of 216 species have been recorded for the LFR (*Siebert et al.* 2002). In terms of the floristic diversity of the larger southern part of Mozambique (including the LFR and the Maputo Elephant Reserve), the Licuáti Thicket contains about 37% of the total number of species occurring within this larger region.

Ferns (comprising two species belonging to two separate genera and two different families) make up about 4.5% of the total flora of the Licuáti Thicket. Monocots (from seven families, eight genera, and ten species) make up about 8.8% of the total flora (Table 1), while the dicotyledons (35 families, 75 genera and 101 species) make up the bulk (89%) of the Licuáti Thicket flora.

Both pterophytes and monocotyledons have a very low diversity at the species level (Table 1), indicating that these groups are not well adapted to the thicket conditions.

Table 1. Number of families, genera and species of Pterophyta, Monocotyledonae and Dicotyledonae recorded from the Licuáti Thicket, LFR.

	Pterophyta		Monocotyledonae		Dicotyledonae		Total
	No.	%	No.	%	No.	%	
Families	2	4.5	7	15.9	35	79	44
Genera	2	2.3	8	9.4	75	88	85
Species	2	1.7	10	8.8	101	89	113

The families of flowering plants are very well represented in the Licuáti Thicket, with the Rubiaceae (coffee family) contributing the most species and genera (Table 2). Twelve families each contribute more than 1% of the total number of species, and collectively account for about 58% of the total number of species.

Table 2. Synopsis of families that contribute 1% or more of the total number in species of the Licuáti Ticket, LFR.

Family	Genera		Species	
	No.	% of total	No.	% of total
Rubiaceae	10	11.7	19	16.8
Euphorbiaceae	6	7	10	8.8
Fabaceae	8	9.4	9	7.9
Anonnaceae	4	4.7	5	4.4
Celastraceae	3	3.5	4	3.5
Asteraceae	3	3.5	4	3.5
Capparaceae	2	2.4	5	4.4
Sapotaceae	2	2.4	2	1.8
Asclepiaceae	2	2.4	2	1.8
Ochnaceae	2	2.4	2	1.8
Flacourtiaceae	2	2.4	2	1.8
Poaceae	2	2.4	2	1.8
Amaranthaceae	1	1.2	1	0.9

According to Van Wyk & Smith (2001) the six families that contributes the largest numbers of endemic/near-endemic species and infraspecific taxa in the MC are: Asclepiadaceae, Euphorbiaceae, Rubiaceae, Liliaceae (in a broad sense), Acanthaceae, and Asteraceae. This differs from what we found for the Licuáti Thicket, where the three families with the largest number of endemics are the Rubiaceae, Fabaceae, and Celastraceae (Table 3), indicating that there are variations in the distribution patterns of the endemic flora within the different

vegetation types of the MC, and that there is a need for further research on this topic. The Rubiaceae contributes eight species or 26.6 % to the total number of Licuáti Thicket endemics (Table 3).

Still looking at the Rubiaceae; in terms of endemism, the Rubiaceae contributes a relatively higher number of endemics to the total flora in the Licuáti Thicket, than it does in the Maputo Elephant Reserve (Table 3), where Licuáti Forest are more prominent. In the Maputo Elephant Reserve, the Rubiaceae only contributes five endemic species, or 13.8% to the total MC endemic flora of this reserve (Siebert *et al.* 2001). The flora of Licuáti Thicket contains 85 small trees and shrubs, of which 15% belong to the Rubiaceae family (Table 4).

Van Wyk (1996) and Van Wyk & Smith (2001) estimates that about 2 500 or more species of vascular plants occur in the MC. Of these, 230 species or subspecific taxa are endemic or near-endemic to the region. The Licuáti Forest contains ca. 30 species, or 13%, and the Maputo Elephant Reserve 36, or 16%, of the total number of endemic specific or infraspecific taxa in the MC.

Table 3. Synopsis of families that contribute 1% or more of the total number of MC endemics in the Licuáti Thicket, as compared to the figures for the Maputo Elephant Reserve.

	Licuáti Sand Thicket		Maputo Elephant Reserve	
Family	Sp.	%	Sp.	%
Rubiaceae	8	26.6	5	13.8
Fabaceae	3	10	2	11.1
Celastraceae	2	6.6	4	8.3
Apocynaceae	2	6.6	2	5.5
Euphorbiaceae	1	3.3	2	5.5
Asteraceae	1	3.3	1	2.7
Asclepiadaceae	1	3.3	1	2.7
Poaceae	1	3.3	1	2.7
Anonnaceae	1	3.3	1	2.7
Ochnaceae	1	3.3	0	0

Table 4. Families, which contribute five or more small tree or shrub species to the flora of the Licuáti Thicket.

	Number of small trees and shrubs	
Family	No.	%
Rubiaceae	13	15
Euphorbiaceae	10	11.7
Anonnaceae	6	7
Fabaceae	5	5.8
Apocynaceae	5	5.8
Celastraceae	5	5.8

Based on the examination of aerial photographs taken in 1958, 1982, and 1989, we found that no significant changes in the structure and size of the Licuáti Thicket and associated Licuáti Forest took place during the past 30 years. This indicates that the Licuáti Thicket [9] is very stable, and has not been subjected to intensive over exploitation that might have had a large influence on the structure and overall size of this vegetation type. The Licuáti Thicket is characterised by the shrubs *Acridocarpus natalitius* subsp. *linearifolius, Artabotrys monteroi, Monodora junodii, Uvaria lucida, Dialium schlechteri* **[18]**, *Hymenocardia ulmoides, and Warneckea sousae*. This species composition contrasts with that of the forest edges, which are subject to more utilisation, and where tall trees such as *Afzelia quanzensis* **[25]**, *Newtonia hildebrandtii, Pseudobersama mossambicensis, and Albizia adianthifolia* occur.

The thicket edges and a small portion of the centre of the thicket in the LFR are subject to some disturbances, mostly fire and some tree felling. As a result of human activity in the area, fire occurrence has increased in frequency recently, and vegetation are sometimes burned during times when it would not naturally and on a regular basis, be exposed to fire. These unnatural burning episodes pose a threat to the natural recruiting processes and have been shown to have a destructive impact on the Licuáti Thicket. Many of these Licuáti Thicket patches and edges that are negatively impacted by unnatural burning regimes do not regenerate at all. On aerial photographs of the Licuáti Thicket taken in 1989, the extent and damage caused by a fire that has occurred years prior to the taking of the photograph was still very clear. This suggests that historical plant dynamics of the Licuáti Thicket might have been a major determinant of the occurrence and extent of the present day patches of this vegetation type (Izidine *et al.* 2002).

Edwards (1983), in his structural classification of vegetation, defined a thicket as a vegetation type where there is a 10–100% tree crown cover of 2–10 m in height and > 10% shrub cover of 1–5 m in height. He defined a forest, on the other hand, as a vegetation type where there is 75–100% tree crown cover of 2–20 m in height and < 10% shrub cover of 1–5 m in height.

The Licuáti Thicket corresponds closely to Edwards' definition of a thicket. It is a distinct vegetation type that is relatively impenetrable and has a very specific species composition. Although Licuáti Forest and Licuáti Thicket have many plant species in common, the Thicket is characterised by species such as *Cleistanthus schlechteri* **[21]**, *Croton pseudopulchellus, Hyperacanthus microphyllus* **[23]**, *Oxyanthus latifolius* **[22]**, *Warneckea sousae, Psydrax locuples* **[16]**, *P. fragrantissima* **[17]**, *Tricalysia junodii* and *Xylopia torrei* **[12, 13, 14]**.

The historical information provided by Chief Santaca is very precise in that the Licuáti Thicket has remained stable since at least the time that he and his brother have been children, and that no change in the structure has occurred for at least the past 30–40 years. These personal testimonies of people that have lived here all their lives refutes the opinion expressed by some ecologists that Licuáti Thicket is just Licuáti Forest with all the tall trees chopped down.

Utilisation and exploitation of the Licuáti Forest Reserve

The Licuáti Forest Reserve is mainly used for grazing purposes for the cattle herds of the local communities and for natural resource based industries such as the production of palm wine, reed harvesting and charcoal production. Agricultural activities take place mostly on the fertile clayey alluvium soils of the floodplains of some of the larger rivers such as the Tembe, Maputo and Futi.

The main crops produced in the area are peanuts, beans, maize, cassava, vegetables, sweet potatoes, mangoes, and paw-paws. Some woody native species are also selectively utilised for timber, building materials, and fuel wood. In the case of timber, the most valuable species that occur in the LFR is *Afzelia quanzensis* **[25]** (Chanfuta), *Newtonia hildebrandtii* and *Terminalia sericea*. Species preferred for building materials (for standing poles, lattice structure, and roofing structure) are *Terminalia sericea, Pteleopsis myrtifolia, Antidesma venosum, Croton pseudopulchellus, Brachylaena discolor, Balanites maughamii, Hymenocardia ulmoides, Sapium integerrium, Monodora junodii* and *Uvaria lucida*.

The need and harvesting of woody plants for fuel wood has probably the largest impact on the vegetation of the Licuáti Forest Reserve. The Directorate of Forests and Wildlife of Mozambique has estimated that over 80% of the population of Maputo depends on fuel wood for their household cooking and heating needs. Most workers have indicated the high demand for this commodity as the major driving force behind deforestation and degradation of natural woodland in Mozambique. Saket (1994) estimated that deforestation was at 20 % around Maputo between 1970 and 1988.

According to Chief Santaca, the major threat to the Licuáti Forest Reserve comes not from the local people, but rather from exploiters from the city of Maputo that are putting a lot of pressure on the plant resources of the reserve. There is an especially high demand for timber and charcoal production, and people from Maputo come to Licuáti to illegally cut timber and produce charcoal in high quantities to sell in Maputo.

The proximity of the LFR to the economic development zone of the biggest city in Mozambique, Maputo, has put renewed pressure on the plant resources of the reserve for rapid economic development to carry the urban population. As a result of urbanisation, some of the people that resettle around the Licuáti Forest Reserve have no regard for cultural taboos, and hence the abundance and diversity of the large tree species have decrease remarkably the past few years (Izidine *et al.* 2002).

Of the 113 vascular plant species recorded in the Licuáti Thicket, about 45 are used for medicinal purposes. This corresponds to about 40% of the total number of species in this vegetation type. The most common parts of plants collected are leaves, roots and bark. The more common medicinal plants are *Balanites maughamii, Tarenna* spp., *Securidaca longipedunculata, Synoptolepis kirki, Xylotheca kraussiana, Acridocarpus natalitiu* var. *linearifolius, Erythrophleum lasiathum, Brachylaena huillensis, Ochna* spp. *and Sapium integerrimum.*

According to Cunningham (1997), high levels of expectations, high rates of unemployment, and a psychologically stressful environment put increased pressure on the medicinal plant market, as many of the traditional medicinal plant and animal materials sold in urban market has a symbolic or psychosomatic value for luck in finding employment, guarding against jealousy, etc.

Although the knowledge and use of medicinal plants are centred or dominated by traditional healers, it is not restricted to them. Every member of the community have at least a working knowledge of first aid treatments, particularly with regard to the most common diseases and medical conditions such as diarrhoea, fevers, and snake and insect bites. This knowledge is not the same as the more extensive knowledge of traditional healers that are passed on within the family (Mangue 1999).

Traditional control and protection of the natural resources of the Licuáti area

Traditionally the people of the Licuáti live with many taboos, rites and believes associated with religion and the graves of their ancestors. According to Chief Santaca, the traditional ceremonies are very important, not only for his family, but for the whole Licuáti community. Taboos (*swiyilayila*) are regulators of resource use. Traditional harvesting practices, such as the harvesting of bulbous plants only after flowering and seeding have taken place, contributes to species conservation (Cunningham 1997).

Certain taboos have also evolved prohibiting the use of some species. The use of *Helichrysum krausii*, which is burnt as incense, is, for example, controlled because of its religious value. There are also taboos on some fuel wood species such as *Garcinia livingstonii, Tabernaemontana elegans* and *Vangueria infausta*. These species are pioneer and fruit bearing species. If a person disregards this taboo in the case of the death of the head of the family (*muti*), it would result in the breaking up of the family of the person who broke the taboo (Mangue 1999).

The Santaca family, from which the current Acting Chief Augusto Santaca comes, is related to two historical chiefs that ruled in the area, namely Maputo and Tembe. Maputo and Tembe were two of the sons of the first King of Matuituine, Uangobe Tembe, who ruled in Kapizulu (also known as Uangobe). King Uangobe's third son, Panhela, took the surname Dlamini, and his descendants now live mostly in Swaziland. The traditional chiefs of the Santaca family play an important role in the control and protection of the natural resources of the Licuáti region. The family name Santaca originated when the second chief whose first name was Santaca, a descendent of Maputo, took the Portuguese names of Jorge Oliveira as first names, and relegated his birth name, Santaca to surname status.

The sacred place is a site in the LFR, where the Santaca family goes to pray and ask for rain, good harvesting and good luck for the whole community. This is an area covered in part by Licuáti Forest.This part of the forest is also the cemetery of the Santaca family and is off limits to other members of the community, unless they get special permission to enter and harvest there from the Chief. The Sacred Forest therefore plays an important role in the conservation of plant resources and of the rare and endemic species that occur there. As a consequence of the prohibition on entry into the Sacred Forest, a major part of the forest remains pristine (Mangue 1999). Trees in the Sacred Forest play a part in birth rites, initiation ceremonies and burial rituals.

In stable rural communities, the cultural and spiritual roles of the vegetation, and the taboos, rites and believes associated with it, still persist, and are even reinforced in the face of encroaching values from outside the communities (Mangue 1999).

Sclerocarea birrea subsp. *caffra* (marula) is the most highly valued tree in the culture of the Ronga ethnic group (to which the Santaca family belongs). As a result of this, when an area is cleared for agriculture timber or firewood *Sclerocarya birrea* subsp. *caffra* is often the only species left standing (Mangue 1999). The celebration of the Feast of the First Fruits of the marula symbolises the celebration of good crops. The elders of the family, the '*regulado*', perform this feast by pouring a libation of the fresh juice of the marula fruit over the tombs of

their dead chiefs (Palgrave 1977; Mangue 1999). If the same kind of importance and protection that is afforded to the marula could be offered to other threatened species such as *Afzelia quanzensis* **[25]**, *Warburgia salutaris* and *Securidaca longipedunculata*, it could have a major positive effect on the conservation of these species.

CONCLUSIONS

- The name Licuáti Thicket is proposed for a distinct vegetation type in southern Mozambique.

- The largest, more or less continuous stands of Licuáti Thicket, is contained the LFR.

- The vegetation of the Licuáti Forest is characterised by tall, generally evergreen trees, while deciduous or semi-deciduous shrubs dominate the vegetation of the Licuáti Thicket.

- Licuáti Thicket contributes 51% of the total vascular plant diversity of the LFR, and harbous about 13% of the species endemic to the MC.

- Of the 113 indigenous species (of which more than 89% are dicotyledons) recorded for the Licuáti Thicket, 30 species are endemic or near-endemic to the MC.

- Although at least 45 medicinal plant species of medicinal importances were recorded for the Licuáti Thicket, most are usually collected outside of the thicket due to the very close and impenetrable characteristic of this vegetation type. This impenetrable nature of the thicket is one of the reasons why the Licuáti Thicket is still in a relatively pristine state.

- Licuáti Thicket covers a significant area within the LFR, and it is clear that this vegetation type has remained stable for the past 30–40 years with little evidence of

disturbance and virtually no indications of significant changes in the structure and extent of the vegetation.

- The structure and floristic diversity of Licuáti Forest, on the other hand, have changed more due to the illegal harvesting and over exploitation by outsiders mainly of the timber species *Afzelia quanzensis* **[25]** (Chanfuta), *Newtonia hildebrandtii* and the fire wood and charcoal species *Acacia nigrescens*, *Combretum imberbe*, *Albizia forbesii*, *Dichrostachys cinerea* and *Terminalia sericea*.

- In the conservation of Licuáti ecosystem, taboos, rites and believes related to the religious and cultural life of the community, as well as the traditional leadership in the area as represented by the Santaca family, played an important role in the past, and can continue to do so in the future, through the impact of indigenous knowledge systems on management practices and resource use patterns in the area.

- The traditional leader of the area, Acting Chief Augusto Santaca, recognises that the unique vegetation and the endemic flora and fauna of LFR, and specially the Licuáti Thicket, are a valuable natural asset and could make the area an important ecotourism destination in southern Africa.

RECOMMENDATIONS

- The LFR should continue to play a role in the conservation of *Afzelia quanzensis*—the main reason for which it was established in the first case. It is further recommended that the Licuáti Thicket, one of the reserve's ecosystems, should be afforded special protection due to its unique structure and floristic composition, diversity, high numbers of MC endemics and limited geographical range.

- Licuáti Thicket should be recognised as a unique vegetation type endemic to the MC, which differs from Licuáti Forest, and every effort should be made to ensure the preservation of this ecosystem for future generations.

- Existing legal roads that pass through the LFR should be kept open for law enforcement purposes, while the illegal roads should be closed down to lessen the pouching and illegal harvesting of the natural resources in the reserve.

- The local communities right to their natural resources must be recognised, thereby empowering them and encouraging them to maintain and use these resources on a sustainable basis. This must be one of the strategies to encourage the conservation of the natural resources of the Licuáti area. In addition it is recommended that traditional knowledge systems (local communities) and law enforcement (government) should work together to ensure the conservation of natural resources.

- The role of traditional (local) leadership in the management of natural resources should be part of the strategy for the conservation of such resources in Mozambique.

- Licuáti Thicket should be developed and promoted as a premier ecotourism destination in Mozambique. It is not only rich in rare plant species, but also harbours many uncommon animals, notably birds.

- Further research should be done in the area to gather more information that can be used to make people aware of the uniqueness of this botanical treasure in Mozambique, and to aid in the development of vegetation dynamics models to guide reserve management, land-use planning, and sustainable utilisation programmes. These tools will facilitate the conservation of these biologically rich, endemic vegetation types for future generations by taking into account both the socio-economic development and the conservation needs of the region.

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ANNONACEAE

THE IDENTITY OF *XYLOPIA TORREI*

INTRODUCTION

The genus *Xylopia* L. belongs to the Annonaceae, a family, which consists of a shrubs and trees characterised by simple, alternate leaves, with stellate or branched hairs or trichomes. Members of the Annonaceae bear single, indehiscent or dehiscent fruit that may, in some cases, appear to be a cluster of several fruits, but which are, in fact, the separate carpels or segments of the same ovary, each one developing independently from the others (Palgrave 2002).

The Annonaceae consists of about 100 genera, with *Xylopia* the only one that is pantropical. Of its c. 160 tropical species, about 61 occur in Africa, and 51 in America. Currently eight species of *Xylopia* are recognised in southern Africa, most of them in the Flora zambesiaca (FZ) region. They are: *Xylopia rubescens* Oliv., *X. aethiopica* (Dunal) A.Rich, *X. acutiflora* (Dunal) A.Rich., *X. katangensis* De Wild., *X. torrei* N.Robson, *X. odoratissima* Welw. ex Oliv., *X. tomentosa* Exell, and *X. collina* Diels.

Habit, leaf shape, hairiness of the leaves, lamina size, length of the pedicels, length of the petals, fruit characteristics, and the arrangement of the seed in the fruit are the main characters that are used to distinguish among the nine southern African species of *Xylopia*. Despite the use of these characters in the available identification keys, herbarium workers often find it difficult to identify the different species. The difficulty to identify species is aggravated by the many misidentified specimens of *Xylopia* in herbaria.

Four species of *Xylopia* have been reported in Mozambique. These are *X. aethiopica, X. parviflora, X. torrei* **[12,13,14]** and *X. collina*. Until recently, *X. torrei* was known from only three collections by Torre made at Chibuto and Panda in Gaza, and Inhambane provinces respectively. It has first been described as a new species by Robson (1958), and was

subsequently taken up in the species list of Lebrun & Stork (1991).

Xylopia torrei, was considered by Robson (1960) to be closely related to *X. holtzii* Engl., which according to Palgrave (2002), is a synonym of *X. parviflora*. Habit, branch colour, the size of the lamina, the hairiness of the leaves, and the type of seed distinguishes it from *X. parviflora (=X. holtzii)*. Differences between *X. torrei* and *X. parviflora*, as well as a comparison of these two species with *X. odoratissima*, are listed in Table 1. Literature studies and observed characteristics, however, suggest that *X. torrei* is more closely related to *X. odoratissima* than to *X.parviflorai* (Table 4).

Very few specimens of *X. torrei* **[12, 13, 14]** have ever been collected, and the identity of this species is unclear. As it has been described as a shrub, and has not been taken up in the standard book of Mozambican trees (Gomes e Sousa 1960). Because so little is known about the species, it has provisionally been listed in the Red Data List for Mozambique (Izidine & Bandeira 2002), and is catagorised as Lower Risk-least concern (LR-lc).

During a ***S***outhern ***A***frican ***Bo***tanical Diversity ***Net***work (SABONET) expedition to southern Mozambique from 22 November 2001 to 12 December 2001, an unexpected discovery of a *Xylopia* species was made whilst collecting in the Licuáti Forest Reserve. This was the first record of *Xylopia* in southern Mozambique. The closest previous records of *Xylopia torrei* are from Chibuto, *A.R.Torre 3944* in 1942 and *Xylopia parviflora* from the Kruguer National Park (Van Wyk 1984).

Table 4. Comparisson between *X. torrei, X. parviflora,* and *X. odoratissima*

Characters	*X. torrei*	*X. parviflora* (=*X.holtzii*)	*X. odoratissima*
Habit	Shrub up to 2 m high	Tall tree up to 30 m high	Shrub or small tree (1–) 2–6 (–9) m high.
Branch colour	Red-brown, turning greyish, eventually glabrous	Red to purplish-black, sparsely yellowish-fawn-pubescent at first, soon glabrous.	Red-brown, densely yellowish-fawn-pubescent at first, eventually glabrous.
Leaf shape	Elliptic or oblong to suborbicular, obtuse or rounded	Narrowly oblong to elliptic, acute or more rarely obtuse or rounded	Elliptic to oblong, rarely lanceolate, obtuse or rarely subacute to rounded.
Hairiness of leaves		Glabrous or sparsely appressed-pubescent above.	Sparsely appressed-pubescent, rarely glabrous above.
Lamina size	15–45 × 12–19 mm	45–110 × 10–47 mm.	35–115 (–135) × 16–57 mm
Pedicel length	4–5 mm long	4–8 mm long	Absent or up to 7 mm long
Length of the petals	Outer: 10–15 mm long	Outer 10–20 (–25) mm long	Outer 18–30 mm. long
Fruit characteristic	On pedicel c. 8 mm long, carpels.	On a pedicel c. 5–8 mm long, carpels 10–80 × 7–11 (–15) mm.	On a pedicel 4–7 mm long, carpels 10–80 × 8–11 mm long.
Type of seeds	5-seeded, subglobular, with stipe 1–2 mm.long.	1–6 seeded, obovoid or cylindric, with stipe 2–9 mm long, seeds 8–11 mm long, ellipsoid, biseriate.	1–5 seeded, obovoid or cylindric, with stipe 3–4 mm long, seed 12 mm long, ellipsoid, biseriate.

The fruit of the *Xylopia* described by Robson (1958) as *X. torrei* were immature and contained one seed per fruit. The fruit of the *Xylopia* that were collected in the Licuáti Forest Reserve during the SABONET expedition were mature and contained several seeds.

The purpose of this paper is to clarify the identity of *Xylopia torrei* **[12, 13, 14]**, and to provide an amplified description of the species, using evidence from macromorphology, leaf anatomy, and leaf surface structure (SEM studies).

MATERIAL AND METHODS

Material of *Xylopia* from the following herbaria was studied: LISC, LMA, PRE, and PRU. For the study of the leaf anatomy and leaf surface structure, both fresh and rehydrated leaves were used. Leaf anatomy was studied using light microscopy (LM), and leaf surface structure by using a JEOL 640 scanning electron microscope (SEM).

Xylopia torrei N.Robson in Bol. Soc. Brot., Sér. 2, 32: 157 (1958). Type: Mozambique, Gaza, Chibuto, *Torre 2350* (LISC, holotype).

Shrub up to 2 m high, branches reddish-brown, turning greyish, eventually glabrous. Leaves petiolate; lamina 20–40 × 12–19 mm, oblong to elliptic to suborbicular, obtuse or rounded to shallow emarginated at the apex, broadly cuneate to rounded at the base; petiole 2 mm long. Flowers solitary or more rarely paired, spreading or reflexed; pedicels 4–5 mm long. Outer petals 10–50 mm long. Capels 4–7 mm. Fruits on pedicel c. 8 mm long; fruiting carpels c. 40–120 × 5 mm, 5-seeded, subgobular, with stipe 1–2 mm long.

CONCLUSIONS

All material examined in terms of both macromorphology and anatomy show that *Xylopia tomentosa* (fig. 9 & 10) is a unambiguous, clear species. It is still difficult to distinguish between the other species, especially between *X. parviflora (=X. holtzii)* and *X. odoratissima* (7 & 8 and 5 & 6). Anatomical differences were found between *X. torrei* and *X. tomentosa*. Only *X. tomentosa* differs significantly from the other species. No significant anatomical differences were found between the other five species studied. The species found in the Licuáti Forest Reserve is provisionally recognised as *X. torrei* according to the type specimen.

The slight leaf anatomical differences found between the leaves of *X. torrei* **[12, 13, 14]** collected in the Licuáti Forest Reserve and the other species may be due to the different ages of the leaf samples, and the fact that some of the rehydrated leaves samples were from old herbarium specimens.

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SPECIMENS EXAMINED

Xylopia torrei N. Robson

Van Wyk 4332 (PRU)

Van Wyk 4345 (PRU)

A.R.Torre 3944 (LMA)

A. R Torre 2350 (LISC)

Xylopia odoratissima Welw.ex Oliv.

Stalman, S.M. 285 (PRE)

D.C.Mc.Ferren 30 (PRE)

F.V. Breitenbach 1312 (PRE)

S. Kandanda 11 (PRE)

Harder, M.Bingham & Luwiika 829 (PRE)

Xylopia parviflora (A. Rich.) Benth

H.P.v.d Schyff 3779 (PRE)

F.V. Breitenbach 16459 (for Herb)

Bremekamp & Schweickerct 348 (PRE)

A.R.Torre, & M.F. Correia 14168 (LMA)

J. Pedro Gomes 4224 (LMA)

M.F. Carvalho 685 (LMA)

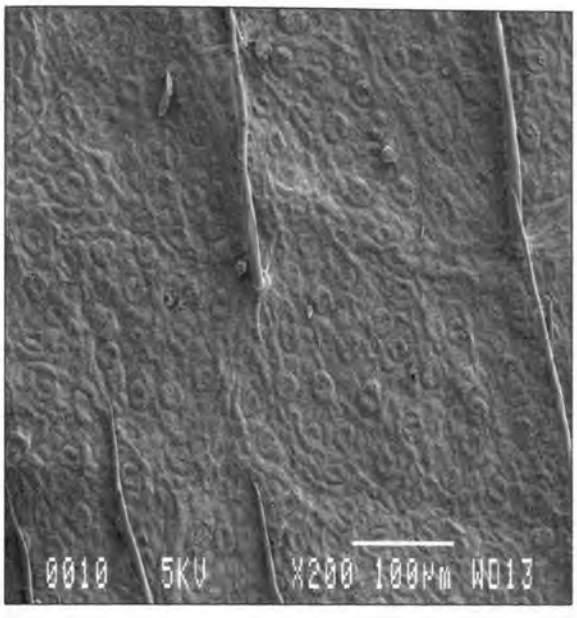
Goldsmith, B. 159/68 (PRE)

Xylopia tomentosa Exell

B. Winter 3845 (PRE)

B. Winter 3879 (PRE)

W. Giess 11358 (PRE



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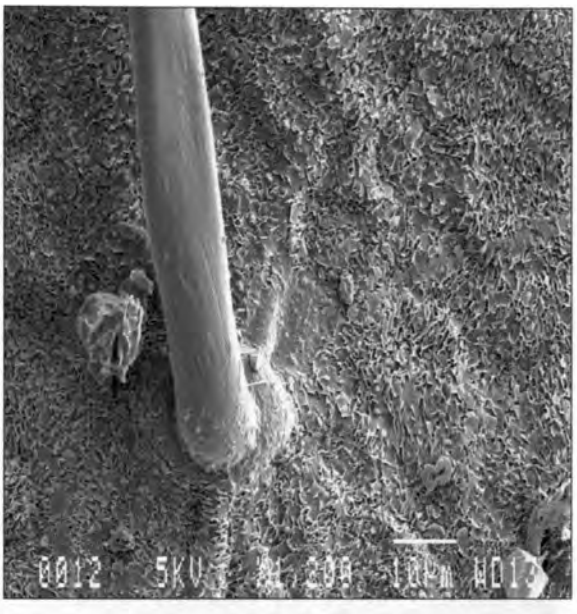

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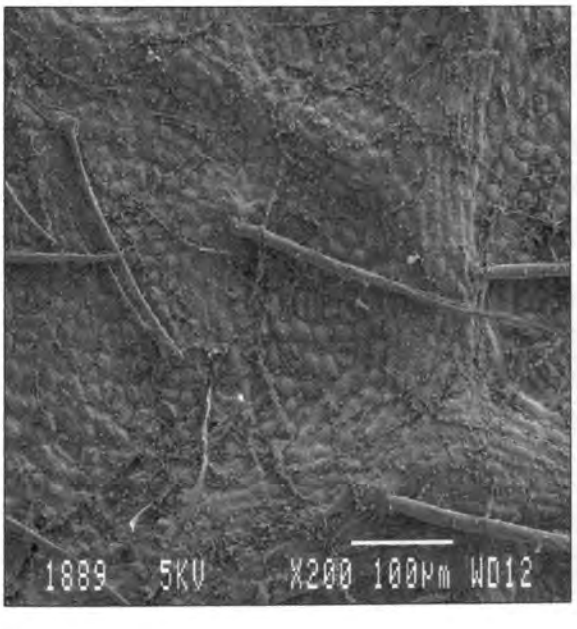

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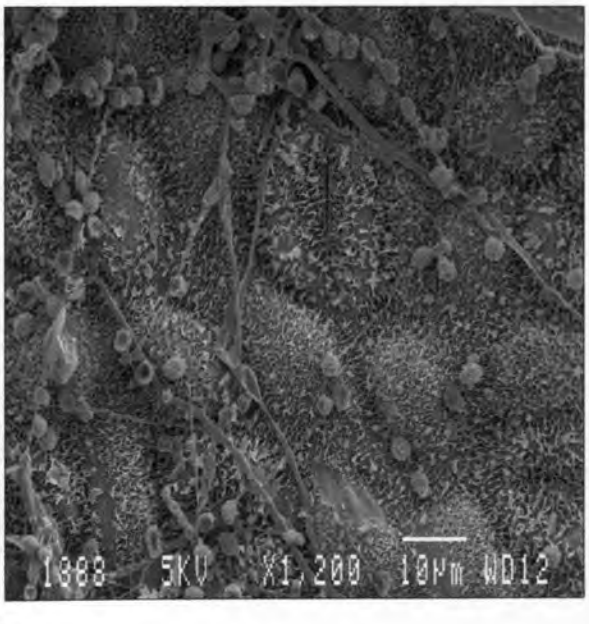
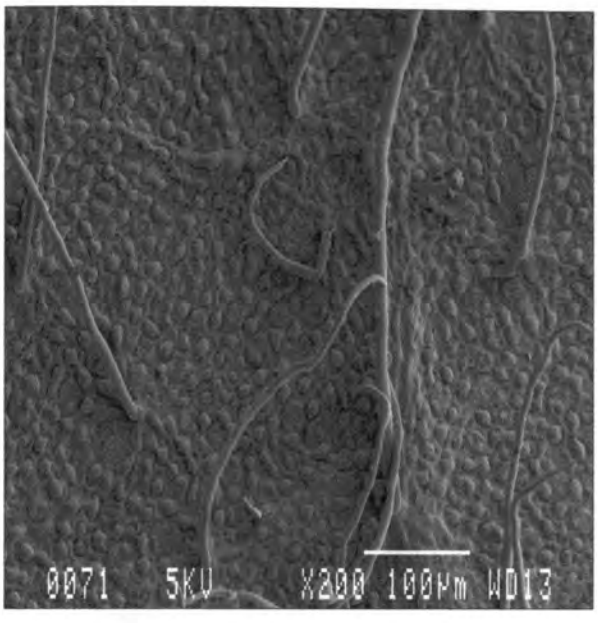


6.

Figures 3–6. SEM micrographs of leaf lower surfaces. 3 & 4 *Xylopia torrei* (Van Wyk 4332). 5 & 6 *X. odoratissima* (D.C. Mc. Ferren 30).



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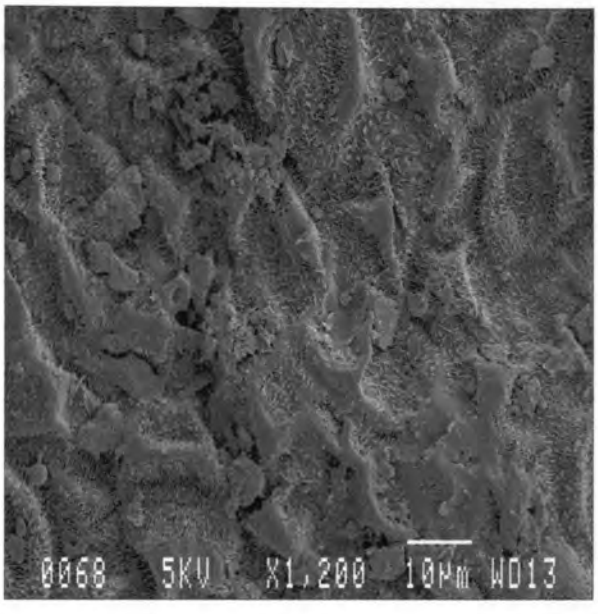

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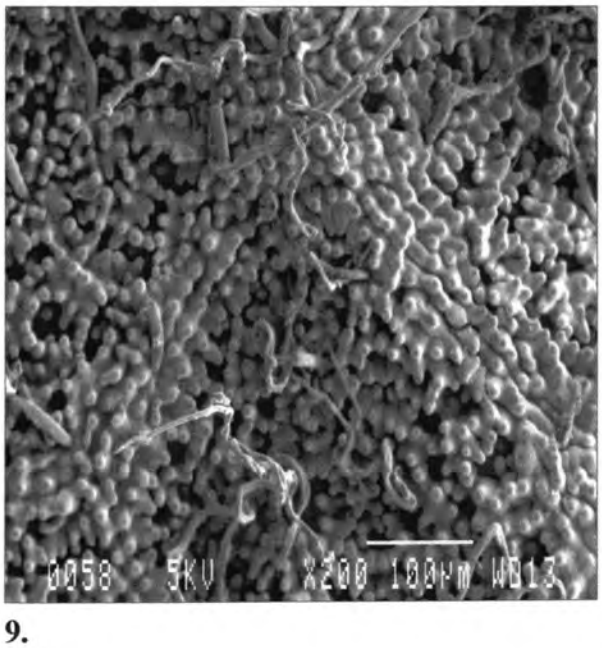

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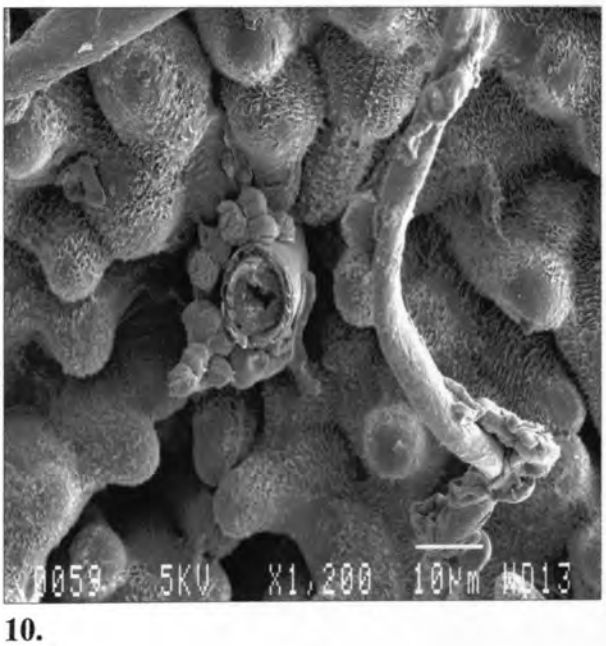

10.

Figures 7–10. SEM micrographs of leaf lower surfaces. 7 & 8 *Xylopia parviflora* (M.F. Carvalho 685). 9 & 10 *X. tomentosa* (B. de Winter 3845).

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SUMMARY

Licuáti Forest Resrve: flora, vegetation and utilisation

by

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The Licuáti Forest (usually referred to as Sand Forest in South Africa) is a very distinctive vegetation type in southern Mozambique. This dry tropical type of forest only occurs in southern Mozambique and northern KwaZulu-Natal, South Africa. The unique combination of rare plants, endemic species and its restricted global distribution make this vegetation type one of the most important plant communities of the Maputaland Centre of Plant Endemism.

The short dense form of Licuáti Forest also known as short Sand Forest covers about 14 000 ha in the Licuáti Forest Reserve in southern Mozambique. It displays a unique vegetation structure, floristic composition and high levels of endemism. Based on Edwards' structural classification of vegetation, we proposed the name Licuáti Thicket for this vegetation type.

The proximity of this Licuáti Forest and Thicket in southern Mozambique to the city of Maputo is putting considerable pressure on the plant resources of the region. Due to the impenetrable nature of Licuáti Thicket, this vegetation type has remained stable over the past 30 years.

The establishment of the Licuáti Forest Reserve was 50 years ago on 14 December 1943 by portaria number 5354, to protect woody species of economic value, especially *Afzelia quanzensis* **[25]** (Chanfuta).

The principal aim of this study was to provide floristic, ecological and etnobotanical information on the Licuáti Thicket.

The flora of the Licuáti Thicket comprises about 113 indigenous species, most (89%) being dicotyledons. Monocots and ferns make up 4.5% and 15% respectively of the total flora of the Thicket. The families of flowering plants are very well represented with Rubiaceae (coffee family) contributing the most species and genera; it is also the most prolific family in terms of endemic species. The Licuáti Thicket contains ca. 30 endemic species, or 13% of the total number of species/infraspecific taxa endemic/near-endemic to the Maputaland Centre.

The Licuáti Thicket is characterised by shrubs such as *Acridocarpus natalitius* subsp. *linearifolius*, *Artabotrys monteiroi, Monodora junodii, Uvaria lucida, Dialium schlechteri* **[18]**, *Hymenocardia ulmoides* and *Warneckea sousae* which contrast with the species composition of the Licuáti Forest which is subject to more utilisation and where tall trees such as *Afzelia quanzensis* **[25]**, *Newtonia hildebrandtii, Pseudobersama mossambicensis,* and *Albizia adianthifolia* occur.

Medicinal plants correspond to about 40% of the total number of species in the Licuáti Thicket. The more common medicinal plants are *Balanites maughamii, Tarenna* spp., *Securidaca longipedunculata, Synaptolepsis kirki, Xylotheca kraussiana, Acridocarpus natalitius* var. *linearifolius, Erythrophleum lasiathum, Brachylaena huillensis, Ochna* spp. *and Sapium integerrimum.*

A checklist is given of the 113 plant taxa recorded in the Licuáti Thicket (Appendix I), arranged by family, with genus and species listed alphabeticaly within, with attributes such as common name, growth form, life history, fruit type and medicinal uses.

The identy of *Xylopia torrei* **[12, 13, 14]** is confirmed. It is the first record of a *Xylopia* for southern Mozambique. Leaf anatomy and macromorphology suggest that the species is closely related to *Xylopia parviflora* and *X.odoratissima.*

Based on historical information provided by Chief Santaca and aerial photographs from 1958, 1982 and 1989, the vegetation structure of the Licuati Thicket has not changed in living memory.

Traditionally the people in the Licuáti Thicket region lived with many taboos, rites and believes associated with religion and the graves of their ancestors. Certain taboos have also evolved prohibiting the use of some species and could play an important role in the conservation of the Licuáti ecosystem.

Available data on vegetation structure, floristic composition, and levels of endemism supports the recognition of the Licuáti Thicket as one of the most important plant communities of the MC. All possible efforts should be made to conserve this biologically rich vegetation type for future generations. Efforts towards this end should take into account both the socio-economic development and conservation needs of the region.

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CURRICULUM VITAE

Samira Aly Izidine was born in Inhambane city, Mozambique, on 20 January 1967. She attended 7 April Primary School and later Emilia Daússe High School in Inhambane, where she graduated in 1978.

In 1983 she attended the Francisco Manyanga Pre-University School in Maputo where she finished the pre-university studies (Matric) in 1984.

In 1986 she enrolled at the Eduardo Mondlane University, Maputo, and was awarded her B.Sc. Honours degree in 1994, with Botany and Ecology as majors.

Samira registered for a Master's degree in Botany at the University of Pretoia in 2002, specialising in Systematics and Conservation Evaluation.

In 1992 she joined the LMA Herbarium, INIA, Maputo as Research Officer, a position she still holds. In 1998 she was appointed Plant Red Data List Mozambique Coordinator as part of a SABONET Project. As Red Data List Coordinator she established the National Red Data List Working Group and organised the first workshop on the dissimination and implementation of Red Data List Concepts in Mozambique.

Presently Samira is involved in the compilation of a Checklist of the Plants of Mozambique. She is also preparing the taxonomic treatments of Cornaceae and Begoniaceae for the Flora of Mozambique.

Apart from plant taxonomy, her interests also include etnobotany, plant ecology and nature conservation.

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APPENDIX 1

ANNOTATED CHECKLIST OF PLANTS OF LICUÁTI THICKET, MOZAMBIQUE

APPENDIX 1. ANNOTATED CHECKLIST OF PLANTS OF LICUÁTI THICKET, MOZAMBIQUE

For an explanation of attributes and abbreviations, see end of list

PTEROPHYTA

PTERIDACEAE
Cheilanthes viridis *(Forssk.) Swartz* var. viridis, *SI 224* PRU
liseka-seka(R)
Eg
H; fern
Water of boiled leaves is taken three times daily to treat venereal diseases.

LYCOPODOPHYTA

SELAGINELLACEAE
Selaginella sp., *SI 225* PRU
Eg
H; fern

ANGIOSPERMAE-MONOCOTYLEDONAE

AMARANTHACEAE
Cyathula natalensis Sond. SI 218 PRU
Eg
H; D

ARACEAE
Zamioculcas zamiifolia *(Lood.) Engl., SI 181* PRU
fern arum(E)
Dc
H; F(berry)

ASPARAGACEAE
Asparagus
africanus *Lam., SI 203* PRU
bush asparagus(E); isigobo(Z)
Eg
Sh/t; F(berry)
Used to treat kidney and stomach complains, chest infections, nausea, colic and as a protective charm.

densiflorus *(Kunth.) Jessop*, *SI 231* PRU
emerald fern(E); uvelabahleke(Z)
Eg
Sh; F(berry)

setaceus *(Kunth.) Oberm*, *SI 136* PRU
cangulatilo(R); ibutha(Z)
Eg
Sh; F(berry)
Used against human lice. The pounded roots are boiled. Baths are taken two times daily.

ASPHODELACEAE

Aloe sp., *SI 214* PRU
chiramacha (R)
Eg; D(capsule)
Used to treat venereal diseases. Pieces of the root are boiled and decoctions taken three times daily.

CYPERACEAE

Cyperus albostriatus *Schrad.*, *SI 202* PRU
forest star sedge(E); selepusamboti (R); ephakathi(Z)
Eg
H; D(nut)

DRACAENACEAE

Sansevieria metallica *Gérome & Labroy*, *SI 158* PRU
mother-in-law's-tongue(E); isitokotoko(Z)
Eg
Sh; F(berry)
Used as remedy for earache, toothache, stomach pains and sexual impotence. Also used to treat intestinal worms, haemorrhoids and as protective charm. Decoction or infusions of the roots and leaves are taken three times daily.

POACEAE

Eragrostis moggii var. moggi *De Winter*, *SI 208* PRU (e)
Pe
G; D(caryopsis)

Panicum deustum *Thunb.*, *SI 222* PRU
Broad-leaved panicum(E); ipunga(R)
Pe
G; D(caryopsis)

ANGIOSPERMAE-DICOTYLEDONAE

ANNONACEAE

Artabotrys monteiroae *Oliv., SI 164* PRU
red hook-berry(E); okonjowati(R); umazwenda(Z)
Dc
St/sh/l; F(berry)

Monodora junodii *Engl & Diels, SI 165* PRU
green apple(E); corá(R); umkotshi(Z)
Dc
St/sh, F(berry)

Uvaria

caffra *E. Mey. ex Sond., SI 205* PRU
small cluster-pear(E); umazwenda-omnyama(Z)
Eg
St/sh/cl; F (berry)

lucida *Benth., SI 217* PRU
large-cluster-pear(E); umavumba(Z)
Eg
St/sh/c; F (berry)
Used to relieve general pains in the body. Roots are boiled and the decoction is taken three times daily.

Xylopia torrei *N.Robson, SI 197* PRU **[12, 13,14]**
Xylopia(E)
Eg
St/sh; F(berry)
Used to treat rheumatism. The decoction is taken three times daily.

APOCYNACEAE

Carissa tetramera *(Sacleux.) Stapf., SI 152* PRU
sand carissa(E); chivelawyelane(R)
Eg
Sh/st; F(berry)

Landolphia kirkii *Dyer, SI 154* PRU
bungue(R); umbungwa(Z)
Dc
sh/cl; F(berry)
Used as anthelmintic. Roots are boiled in water and the infusion is taken orally three times daily as a tea.

Strophanthus

gerrardi *Stapf.*, *SI 219* PRU (e)
poison-rope(E); umhlazazane(Z)
Eg
St/sh; D(follicle)

luteolus *Codd.*, *SI 192* PRU
golden poison-rope(E)
Eg
Mt; D(follicle)
Used as remedy for general body pains. The decoction is taken three times daily.

petersianus *Klotzsch.*, *SI 220* PRU
corky-stem poison-rope(E); ubuhlungubendlovu(Z)
Eg
Lt; D(follicle)
Used as a charm against evil. Baths are taken two times daily.

Tabernamontana elegans *Stapf*, *SI 182* PRU
toad-tree(E); caxuana(R); umkhahlwana(Z)
Dc/SDc
St/sh; F(berry)

ASCLEPIADACEAE

Sarcostemma viminale *(L.) R. Br.*, *SI 186* PRU
Caustic vine(E); lineata (R); umpelepele(Z)
Dc
H; D(follicle)
Used to treat venereal diseases, as diuretic and to increase milk during lactation.
Water of boiled roots is taken three times daily.

Secamone delagoensis *Schltr.*, *SI 206* PRU (e)
ikhoka (R)
Eg
Cl; D(follicle)

ASTERACEAE

Brachylaena huillensis *O. Hoffm.*, *SI 215* PRU
lowveld silver oak(E); iphahlalahlathi(Z)
Eg
St/mt; D(nut)

Helichrysum krausiii *Sch. Bip.*, *SI 213* PRU
chirimbati(R)
Eg
Sh, D(nut)
Used as ritual incense, called *imphepho.* The smoke of roots and leaves are used in small babies to avoid epilepsy.

Senecio

barbertonicus *Klatt.*, *SI 207* PRU
succulent bush senecio, jelly-beans (E);
Eg
Sh; D(nut)

viminalis *Bremekamp*, *SI 223* PRU
leafless climbing senecio(E); uqobaqoba(Z)
Eg
Cl; D(nut)

BALANITACEAE

Balanites maughamii *Sprague*, *SI 159* PRU
torchwood(E); chicocuane(R); ugobendlovu(Z)
Dc
Lt/mt; F(drupe)
Used to strengthen the body and as ritual emetic. Bark is applied in the form of sub-cutaneous implantations to strengthen the body and the root bark is mixed with other ingredients for use as emetics.

CAPPARACEAE

Boscia

foetida Schinz subsp. longipedicellata *(Gilg.) Tolken*, *SI 137* PRU
smelly shepherd tree(E); umvithi(Z)
Eg
St/sh; F (berry)

foetida Schinz subsp. rehmanniana *(Pest.)Tolken* , *SI 198* PRU
stink shepherd's tree(E); umlalampisi(Z)
Eg
St; F(berry)

salicifolia *Oliv., SI 226* PRU
willow-leaved shepherds-tree(E), jose(Z)
Dc
St/mt; F(berry)

sp. nov., *SI 169* PRU

Capparis sepiaria *L. SI 190* PRU
wild caper-bush(E); usondeza(Z)
Eg
St/sh/cl; F(berry)

CELASTERACEAE
Hippocratea delagoensis *Loes., SI 173* PRU (e)
shicocumbela (R)
St/sh/cl; D(pod)
Used to treat rheumatism. The decoction is taken three times daily.

Maytenus undata *(Thunb.) Blakelock, SI 175* PRU
dune koko tree(E); mugumo(R); idohame(Z)
Eg
Lt/sh; D(capsule)

Salacia
krausii *(Harv.) Harv., SI 227* PRU (e)
salacia(E); mabsisa(R); mbontsi(Z)
Eg
St/sh; F(berry)

leptoclada *Tul., SI 170* PRU
lemon rope(E); uhlangahomo(Z)
Eg
St/sh; F(berry)

COMBRETACEAE
Combretum
celastroides *Welw. ex M.A. Lawson, SI 143* PRU
savanna bushwillow(E); mbabolile(R)
SDc
St/sh; D(samara)

mkuzense *J.D.Carr & Retief., SI 168* PRU (e) **[15]**
bushwillow(E); mkuze(Z)
Dc
St/t; D(samara)

Pteleopsis myrtifolia *(M.A. Lawson) Engl. & Diels, SI 133* PRU
stink bushwillow (E); amuyadi (R); umwandla (Z)
Dc
St/sh; D(samara)

EBENACEAE
Euclea natalensis *A.DC., SI 201* PRU (e)
large-leaved guarri(E); hlangula(R); inkunzi-emnyama(Z)
Eg
St/sh; F(berry)
Used to treat general diseases and also as tooth sticks.

ERYTHROXYLACEAE
Erythroxylum emarginatum *Thorn., SI 185* PRU
common coca tree(E); uphaphane(Z)
Eg
St/sh; F(berry)

EUPHORBIACEAE
Cleistanthus schlechteri *(Pax.) Hutch. SI 194* PRU **[21]**
bastard tamboti(E); umzithi(Z)
Dc
Mt/st; D(capsule)
Used to treat evil. Mixed with roots of *Synaptolepis kirki*, the decoction or infusion is taken three times daily.

Croton
gratissimus *Burch., SI 240* PRU
lavender-croton(E); ilabele(Z)
Dc
St/sh; D(capsule)

menyhartii *Pax., SI 139* PRU
rough-leaved croton(E)
Dc
St/sh; D(capsule)

pseudopulchellus *Pax., SI 130* PRU
small lavender tree(E); dilhambo(R); uhubeshane(Z)
Dc
St/sh; D(capsule)
Used to treat malaria. Inhalations of infusions of the leaves are taken two times daily.

steenkampianus *Gerstner, SI 179* PRU (e)
marsh croton(E); uhubeshane omkhulu(Z)
Dc
St/sh; D(capsule)

Drypetes
arguta *(Müll Arg.) Hutch., SI 195* PRU
water drypetes(E); iskolemfene(Z)
Eg
St/sh; F (berry)

natalensis *(Harv.) Hutch., SI 200* PRU
natal drypetes(E); umgunguluza(Z)
Eg
Mt/st; F(berry)

Hymenocardia ulmoides *Oliv., SI 191* PRU
red heart-tree(E); tshatsalatani(R); umdlamahlathi(Z)
Dc
Mt/st; D (samara)

Sapium integerrimum *(Hochst. ex.C.Krauss) J. Léonard., SI 176* PRU
duiker-berry(E); encheha(R); umhlepha(Z)
Dc
Mt/st; D(capsule)
Used to treat heart diseases and high blood pressure. Decoctions of the root are taken three times daily.

Suregada zanzibariensis *Baill., SI 146* PRU
woodland suregada(E); djlamunti(R); umdlankawu(Z)
St/sh; D(capsule)
Used to treat fever. Decoctions of the leaves are taken.

FABACEAE

Albizia

adianthifolia (Schumach) *W. Wright, SI 161* PRU
rough-bark flat-crown(E);gouana(R); igowane(Z)
Dc
Lt; D(pod)

versicolor *Oliv., SI 212* PRU
large-leaved false thorn(E); umpiso(R); umphisu(Z)
Dc
Lt/mt; D(pod)

Afzelia quanzensis *Welw., SI 209* PRU **[25]**
pod mahogany(E); chanfuta(R); inkele(Z)
Dc
Lt/mt; D(pod)

Crotolaria monteiroi var. monteiroi *Taub. ex. Baker* f., *SI 166* PRU (e)
Small-leaved rattle-pod(E); lekalahumba(R); uhashazi(Z)
SDc
Lt/mt; D(pod)

Dalbergia nitidula *Baker, SI 132* PRU
glossy flat-bean (E)
Dc
Mt/sh; D(pod)

Dialium schlechteri *Harms, SI 129* PRU **[18]**
zulu-podberry(E); insiba(R); umthiba(Z)
Dc
Mt/st, D(pod)
Used to treat chest pains. Roots, together with roots of *Manilkara discolor,* are boiled and the decoction is taken three times daily.

Erythrophleum lasianthum *Corbishley, SI 147* PRU (e)
swazi ordeal tree(E); umhlakazane(Z)
Dc
Lt/mt; D (pod)
Used as remedy for headaches, migraine and general pains. The powered bark is used as snuff, after being dried and pounded.

Indigofera podophylla *Benth ex.Harv., SI 204* PRU (e)
hlenyenyani(R)
Dc
St/sh; D(pod)

Mundulea sericea *(Wild.) A. Chev., SI 163* PRU
cork bush(E); citana(R); umamentabeni(Z)
SDc/Eg
St/sh; D(pod)

FLACOURTIACEAE
Dovialis longispina *(Harv.) Warb., SI 187* PRU (e)
natal apricot(E); nhangatsune(R)
Eg
Mt/st; F(berry)

Xylotheca kraussiana *Hochst., SI 155* PR
african dog rose(E); gutana(R); isishwashwa(Z)
Eg
St/sh; D(capsule)
Used as anthelmintic in childrens. Roots are boiled and the decoction is taken before meals, three times daily.

LAMIACEAE
Plectranthus sp., *SI 230* PRU
bozane (R)
H/sh(P); D(nut)
Used to treat fever. Leaves are boiled and the decoction is taken three times daily.

LAURACEAE
Cassytha filiformis *L., SI 216* PRU
false dodder(E); umkhunga(Z)
Eg
H(P); F(drupe)
Used to treat malaria. An infusion of the root, mixed with root of *Croton pseudopulchellus,* is taken twice daily.

MALPIGHIACEAE
Acridocarpus natalitius *A. Juss* var. linearifolius *Launert, SI 162* PRU (e)
moth-fruit(E); mabope(R); umabopha(Z)
St/sh/cl; D(samara)
Used to prevent several illnesses. Roots are boiled and decoctions taken three times daily.

MELASTOMATACEAE
Warneckea sousae *(A. & R. Fernandes) A.E. van Wyk, SI 144* PRU (e)
Tonga false rose apple (E)
Eg
St/sh; F(berry)

MELIACEAE
Pseudobersama mossambicensis *(Sims) Verdc., SI 189* PRU
false white ash(E); umopho(Z)
Eg
Mt/st; D (capsule)

MENISPERMACEAE
Albertisia delagoensis *(N.E.Br.) Forman., SI 228* PRU
umgandaganda(Z)
Eg
Sh; F(berry)
Used to treat constipation, intestinal complications and worms.

Cissampelos hirta *(Lodd.) Engl., SI 196* PRU (e)
djebehabo(R)
Eg
Cl; F(berry)
Used as remedy for stomach problems, diarrhoea and cholera and also for easing childbirth. Roots are boiled and the decoction or infusion taken three times daily.

MYRTACEAE
Eugenia mossambicensis *Engl., SI 134* PRU (e)
nkelenkele (R);
St/sh; F(berry)
Used to prevent worms in children. Water of boiled roots is taken three times daily.

OCHNACEAE
Ochna
barbosae *N. Robson, SI 174* PRU (e) **[24]**
sand plane(E); giwongwani(R)
Dc
St/sh; F(drupe)

natalitia *(Meisn) Walp., SI 171* PRU (e)
natal plane(E); driwongwani(R); isendengulube(Z)
Dc
St/sh; F(drupe)
Used to treat cough. Roots and leaves are boiled and the decoction is taken as a tea three times daily.

OLACACEAE
Olax dissitiflora *Oliv., SI 199* PRU
small sourplum(E); lijamuntani(R); umaphunzana(Z)
Dc
St/sh; F(drupe)
Used for fever conditions. Leaves are mixed with the bath water for children to decrease in high temperatures.

OLEACEAE
Olea
capensis *L., SI 234* PRU
false ironwood(E); umsishane(Z)
Eg
Lt/st/sh; F(drupe)

europaea *L.* subsp. africana *(Mill.) P.S.Green, SI 127* PRU
wild olive(E); umnqumo(Z)
Eg
Mt/st/sh; F(drupe)

POLYGALACEAE
Securidaca longepedunculata *Fresen., SI 229* PRU
violet tree(E); mulha-lhovo(R)
Dc/Eg
St/sh; D(samara)
Used to treat cough, and chest complaints, toothache and headache. For chest complaints and rheumatism a decoction of parts of the plants is taken while the root is chewed to relieve toothache. The powered root or wood scrapings are rubbed into scarifications on the forehead to treat headaches.

PTAEROXYLACEAE

Ptaeroxylon obliquum *(Thunb.) Radlk, SI 178* PRU
Sneezewood(E); dzarre (R); ubhaqa(Z)
Dc
Lt/st; D(capsule)
Used to treat headache, rheumatism and arthritis. Powered wood is used as a snuff to relieve headache. A decoction or infusion of the wood and bark is used for treatment of rheumatism and arthritis.

RHIZOPHORACEAE

Cassipourea

mossambicensis *(Brehmer) Alston, SI 150* PRU (e)
sand onionwood(E); mnyamanzi(Z)
Eg
St/sh; D(capsule)

sp., *SI 239* PRU
urungwe onionwood(E)
Eg
St; D(capsule)

RUBIACEAE

Canthium setiflorum subsp. setiflorum *Hiern., SI 172* PRU (e)
rough-leaved rock(E); txandulankumba(R); umbhangwe(Z)
St/sh; F(drupe)

Catunaregam spinosa *(Thunb.) Tirvengadum, SI 211* PRU
thorny bone-apple(E); balekane(R); umaqhathini (Z)
Dc
Mt/st; F(drupe)
Used against worms in child. Roots decoction is taken three times daily.

Hyperacanthus

amoenus *(Sims) Bridson, SI 236* PRU
spiny-gardenia; thorny gardenia(E)
Eg
St/sh;F(drupe)

microphyllus *(K. Schum.) Bridson, SI 145* PRU (e) **[23]**
umtembezwana(Z)
Eg
St/sh; F(drupe)
Used to treat spirit problems. Roots are boiled with those of *Tarenna supra-axilaris* and taken three times daily.

Leptactina delagoensis *K. Schum., SI 184* PRU
sandnightstar, nightstarbush(E)
Eg
Sh; F(drupe)

Oxyanthus latifolius *Sond., SI 157* PRU (e) **[22]**
Zulu loquat(E); umdlankawu(Z)
Eg
St/sh; F(drupe)
Used to treat abscesses. Fresh leaves are chewed and boiled and the infusion used externally.

Pavetta
gerstneri *Bremek., SI 237* PRU (e)
Zulu bride's bush(E); chibandichachôco(R)
Dc
St/sh; F(drupe)

schumanniana *F.Hoffm. ex. K. Schum., SI 141* PRU
poison bride's bush(E); isimbuzana(Z)
Dc
Sh; F(berry)

Psydrax
fragrantissima *(K. Schum.) Bridson, SI 135* PRU (e) **[17]**
Tonga quar(E)
Eg
Sh/t; F(drupe)

locuples *(K. Schum.) Bridson, SI 138* PRU (e) **[16]**
krantz quar(E); xixlovongo(R)
Eg
St/sh; F(drupe)
Used to relieve burns. Dried chewed leaves are applied on wounds.

obovata *(Eckl.& Zeyh.) Bridson SI 214* PRU
quar (E); terentele(R)
Eg
St/sh; F(drupe)

Rothmannia fischeri *(K. Schum.) Bullock, SI 210* PRU
woodland rothmania(E); umkotshi-wenyama(Z)
Eg
St/sh; F(berry)

Tarenna
junodii *(Schinz) Bremek., SI 156* PRU
climbing dune tarenna(E); ligangani(R); amabamba(Z)
Dc
St/sh; F(drupe)

nigrescens *(Hook f.) Hiern., SI 238* PRU
blackbutterspoon(E)
Dc
Cl/sh/st; F(drupe)

supra-axilaris *(Hemsl.) Bremek., SI 183* PRU
narrow-leaved false bride's bush(E); ukukulaketelo-lehlathi(Z)
Dc
St/sh; F(drupe)
Used against evil. Cold water is poured over a small quantity of powdered roots, and the patient takes the foam.

Tricalysia
delagoensis *Schinz., SI 167* PRU (e) **[20]**
tonga jackal-coffe(E); tsindi (R)
Dc
Sh/st, F(drupe)

junodii *(Schinz.) Brenan* var. junodii., *SI 148* PRU (e)
xisimelahlapfi(R)
Dc
Sh; F(drupe)

lanceolata *(Sond.) Burtt Davy* SI 128 PRU
common tricalysia (E); thisindi (R); umdleza (Z)
Eg
St/sh; F(drupe)

maputensis *Bridson & A.E. van.Wyk* ined. *SI 177* PRU (e) **[19]**
Pe
Sh; F(drupe)

RUTACEAE
Toddalliopsis bremekampii *I. Verd., SI 151* PRU (e)
wild mandarin(E); intane(Z)
Eg
St/sh; F(berry)
Used to treat rheumatism. Decoctions or infusions of the roots are taken three times daily.

Teclea cf. myrei *Exell & Mendonça, SI 235* PRU
cherry orange(E); mutza (R)
Eg
St; F(berry)

SAPOTACEAE
Inhambanella henriquessii *(Engl. & Warb.) Dubard, SI 188* PRU
inhambanella(E); umbenkela(Z)
Eg
T; F(berry)

Manilkara discolor *(Sond.) J.H.Hemsl., SI 160* PRU
forest milkberry(E); nheve(R); umnqambo(Z)
Dc/SD c
Lt/mt; F(berry)

SCROPHULARIACEAE
Buttonia natalensis *Mckew ex. Benth., SI 232* PRU
umhlanhalaze enkulu(Z)
Eg
Sh/cl(P); D(capsule)
Used to treat general infections. Root decoction is taken three times daily.

STRYCHNACEAE
Strychnos
madagascariensis *Poir.*, SI 153 PRU
black monkey orange(E); macuacua(R); umnconjwa(Z)
Dc
St/sh; F(berry)

spinosa *Lam.*, *SI 131* PRU
green monkey orange(E); massala(R); umhlalakolontshe(Z)
Dc
St/sh; F(berry)

THYMELAEACEAE
Synaptolepis kirkii *Oliv.*, *SI 140* PRU
uvuma omhlophe(Z)
Eg
Sh; F(berry)
Used as an emetic. Also used to treat epilepsy and constipation. A root decoction or infusion is taken three times daily.

TILIACEAE
Corchorus junodii *(Schinz) N.E.Br.*, *SI 180* PRU (e)
chimbati (R); igusha(Z)
H/sh (P); F(capsule)

VERBENACEAE
Vitex amboniensis *Guerke*, *SI 149* PRU
large-fruited vitex(E); umphenduka(Z)
Dc
St/sh; F(berry)
Used to treat conjunctivitis and cataracts. Roots decoctions are used to wash the eyes, four days weekly.

VITACEAE
Rhoicissus revoillii *Planch.*, *SI 142* PRU
bushveld grape(E); chilucarelo(R)
Dc
Cl; F(berry)
The latex is used to treat cows cataracts and is applied to the eyes two times daily.

Cissus rotundifolia *(Forssk.) Vahl.*, *SI 193* PRU
bushveld grape(E); sungaunhe(R); umjovane(Z)
Dc
Cl; F(berry)

ANNOTATED CHECKLIST

LEGEND

Scientific name, follows by **Authority**, sometimes by **var.** = variety or **subsp.** = Subspecies.

Endemicity: **(e)** = Endemic/near-endemic to Maputaland Centre of Endemism.

Common Name: **E** = English, **R** = Ronga, **Z** = Zulu.

Life History: **Eg** = Evergreen, **Dc** = Deciduous, **SDc** = Semi-deciduous, **Pe** = Perennial.

Growth form/Habit: **H** = Herb, **G** = Grass, **Cl** = Climber, **L** = Liane, **Sh** = Shrub, **ST** = Smal Tree, **MT** = Medium Tree, **LT** = Large Tree, **(P)** = Parasite.

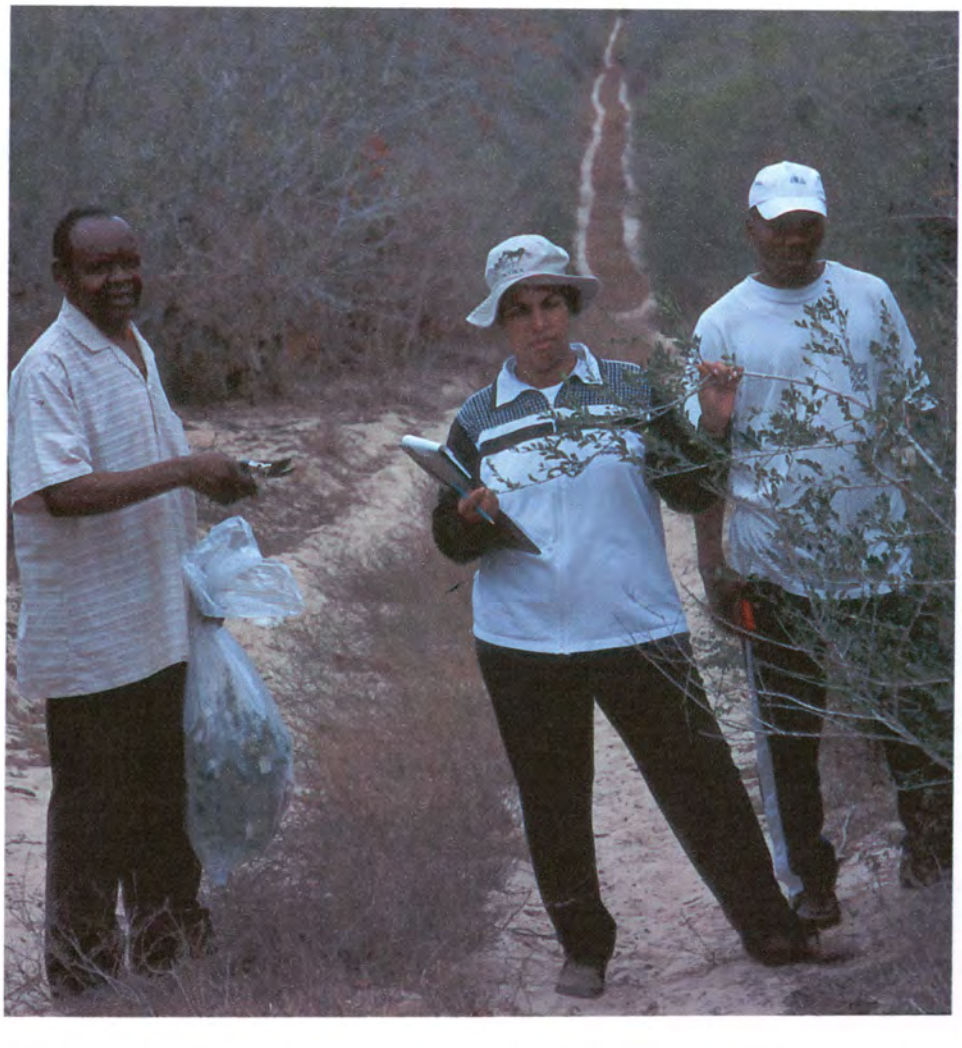
Fruit Type: **F** = Fleshy, **D** = Dry; sometimes followed the by specific fruit type in brackets.

Medicinal Uses

APPENDIX 2

MISCELLANEOUS PHOTOGRAPHS

1. Mrs Izidine in Licuáti Thicket during plant collecting field trip.



2. Mr Macitela (left), Mrs Izidine and Mr Manhique (right) investigating plants.

3.

4.

5.

3. Chicken prepared for traditional ceremony

4. Mr Nguenha cutting chicken.

5. Mr Santaca pouring wine for the ancestors

6. Group photo taken at Sacred Forest.
From left to right: Mr Macitela, Mr Vilanculos, Mrs Izidine, Mr Santaca, Mr Manhique and Mr Ngwenha.

7. Aerial photograph of Licuáti Forest patches in woodland, southern Mozambique.

8. Aerial photograph of Licuáti Forest, southern Mozambique..

9. Aerial photograph showing Licuáti Thicket, Licuáti Forest Reserve, southern Mozambique.

10. Road through Licuáti Thicket, Licuáti Forest Reserve.

11. Road through Licuáti Thicket showing undulating dunes.

12. *Xylopia torrei* (flowers).

13. *Xylopia torrei* (young fruit).

14. *Xylopia torrei* (dehisced fruit).

15. *Combretum mkuzense* (MC endemic).

16. *Psydrax locuples* (MC near-endemic).

17. *Psydrax fragrantissima* (MC endemic).

18. *Dialium schlechteri* (MC near-endemic).

19. *Tricalysia maputensis* (MC endemic).

20. *Tricalysia delagoensis* (MS near-endemic).

21. *Cleistanthus schlechteri* (fruit).

22. *Oxyanthus latifolius* (MC endemic).

23. *Hyperacanthus microphyllus* (MC endemic).

24. *Ochna barbosae* (MC near-endemic).

25. *Afzelia quanzensis* (Chanfuta) chopped down for timberwood.