

**BARK IN TRADITIONAL HEALTHCARE
IN KWAZULU-NATAL, SOUTH AFRICA**

USAGE, AUTHENTICATION AND SUSTAINABILITY

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“Trees with medicinal value are victims of their own success” – Gates 2000.

ABSTRACT

Healthcare in South Africa is polarised between western and traditional African systems of therapy. The latter is consulted by the majority of the population and therefore plays an integral role in the delivery of healthcare to South Africans. Traditional medicines are primarily plant products with long storage lives, among which the dominance of bark is typical of southern African traditional healthcare systems.

Expansion of the traditional healthcare sector during the twentieth century, in response to rising consumer demands, stimulated a lucrative trade in medicinal plants that is centred in KwaZulu-Natal. Since herbal medicines are sourced almost exclusively from indigenous vegetation, harvesting pressures exerted on the indigenous flora to meet demands for traditional medicines have rendered such resources non-sustainable. Although trees comprise a small fraction of South African medicinal plant species, bark from them constitutes a substantial proportion of the plant products used medicinally.

Trees are among the most threatened medicinal plants in South Africa due to their limited abundance, the ecological sensitivity of the vegetation in which they occur, and destructive methods of commercial bark harvesting that frequently take place within protected areas. In KwaZulu-Natal, bark is harvested primarily from forests that occupy an extent of only 0.1 % in the province. Conservation of economically valuable tree species is particularly problematic since data necessary for the establishment of sustainable usage systems are absent or inaccessible. Alternatives to *in situ* conservation for renewable bark resources include propagation, multi-use timber systems and reintroduction of locally extinct species.

To facilitate appropriate management of bark resources, there is a need for specialist publications and consolidated data with which sustainable usage levels may be determined. The importance of bark in South African traditional healthcare is poorly reflected by the ethnobotanical literature. In this study, 180 bark species used in traditional healthcare in KwaZulu-Natal were inventoried from thorough literature surveys, but this number is anticipated to be a conservative reflection of actual statistics. Where trade data were recorded in the literature, they indicated intensive exploitation of bark resources in KwaZulu-Natal and throughout South Africa, but conservation and management data were lacking for 72 % of the species inventoried. A number of problems were encountered in the literature, of which vague information and the documentation of local vernacular nomenclature were the most troublesome.

Despite the importance of traditional medicine, the country's political history led to the prevailing situation, where the traditional healthcare sector is largely unregulated. Coupled with increasingly limited availability of medicinal plants, the quality and appropriate use of traditional medicines is negatively affected

by growing numbers of inadequately trained practitioners, herbalist retailers and plant gatherers. Possibilities of misidentification or purposeful adulteration of medicinal bark products therefore lead to concerns for patient safety, since dried bark is difficult or impossible to identify. Whilst bark characters are useful for field identifications, many useful diagnostic characters are lost through desiccation, and anatomy and morphology of bark are variable. Additionally, medicinal bark products used in KwaZulu-Natal, and their identification, are largely undocumented. This study focussed on eight bark species used medicinally in the province, elected by an esteemed traditional medical practitioner as having problematic identity. Monograph-type characterisation profiles were drawn up for reference specimens collected from various localities, and their medicinal bark products traded under vernacular names recorded in the literature.

In the absence of standardised traditional medicines, there is a need for reliable and affordable methods for their authentication. Phytochemical bark characters identified by Thin Layer Chromatography (TLC) have proved useful in chemotaxonomic studies, and the technique is widely used for herbal drug authentication. TLC was tested here for authentication of medicinal bark products from the aforementioned study species. Three reference samples of each species were collected, and TLC-generated fingerprints compared. At the intraspecific level, TLC was useful in confirming the relationship of ethanol and hexane bark extracts, but was less meaningful in distinguishing between fingerprints of different species. Three medicinal bark products of each study species were purchased and fingerprints compared to a reference. The technique proved useful in confirming the identity of several medicinal bark products. Authentication of medicinal bark products may be useful in toxicology cases and in the accurate documentation of their trade.

This research identified a complexity of issues surrounding the use of bark in traditional healthcare in KwaZulu-Natal, and indeed South Africa. A multi-faceted approach is required to secure their sustainability. Critical, however, to factors such as effective conservation and regulation of the traditional healthcare sector, is recognition of the importance, and documentation, of traditional bark medicines. The integrity of traditional healthcare, and the future of the South African flora, hinge upon the sustainable use of medicinal products such as bark.

PREFACE

The experimental work described in this dissertation was carried out in the Research Centre for Plant Growth and Development, School of Botany and Zoology, at the University of Natal, Pietermaritzburg, from January 2001 to March 2002, under the supervision of Doctor AK Jäger (presently of the Department of Medicinal Chemistry, Royal Danish School of Pharmacy, Denmark) and Doctor HDV Prendergast (Centre for Economic Botany, Royal Botanic Gardens, Kew, United Kingdom), and Professor J van Staden (Research Centre for Plant Growth and Development, University of Natal, Pietermaritzburg).

This dissertation, submitted for the degree of Master of Science in the Faculty of Science and Agriculture of the University of Natal, Pietermaritzburg, represents original work by the author, except where the work of others is acknowledged. These studies have not otherwise been submitted in any form for any degree or diploma.

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My family and friends are thanked for their encouragement and support. I wish to dedicate this dissertation to my late father, Doctor HJ Grace, whose memory has inspired my academic career.

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An introduction to South African traditional healthcare and the role of bark medicines

Traditional healthcare in South Africa

Healthcare in South Africa is almost exclusively polarised between Western-style and traditional African healthcare systems. Whilst government health services provide only Western therapy, it is well known that the majority of the population continues to make use of traditional medicine. For some ailments, particularly spiritual, psychological and religious complaints, allopathic medicine is not an alternative to the services of a traditional practitioner (CUNNINGHAM 1988, MANDER 1998).

The diverse cultural groups within South Africa subscribe to their own traditional systems of therapy, yet similarities in structure are evident. Most important among practitioners of traditional medicine are the diviner (Zulu: 'isangoma', 'izangoma' pl.) and herbalist ('nyanga', 'izinyanga' pl.) (CUNNINGHAM 1988). Following the popular press, the diviner is termed here 'sangoma', and the herbalist 'nyanga'. The sangoma, a spirit-guided diagnostician, is consulted as a medium of ancestral spirits to establish the cause of an ailment or complaint; the patient is subsequently referred to the nyanga, an apothecary who prescribes, prepares and dispenses medicines for treatment (BYE & DUTTON 1991, VAN WYK *et al.* 1997, SPRING 2001). In modern times, distinctions between the sangoma and nyanga have become blurred, as a healer may both diagnose and treat a patient (SPRING 2001). Other traditional medical practitioners include traditional birth attendants, traditional surgeons and spiritual healers (collectively 'isanyoni'). Although most people have some knowledge of traditional remedies, the elderly fulfil an important role in South Africa, due to their extensive knowledge of herbal remedies and first aid (NGUBANE 1992, VAN WYK *et al.* 1997). It must be stressed that witchdoctors ('umthakathi') are practitioners whose practice may even cause injury or death to people¹ (BODENSTEIN 1973, SPRING 2001).

Traditional medicines are referred to here in the broadest sense, as any material used in curative, preventative or rehabilitative treatment, according to traditional or cultural principles, either by self-medication or through consultation with a traditional medical practitioner. CUNNINGHAM (1988) referred to traditional medicine plants as those used for physiological, psychological or religious purposes.

¹ It is this practice that is implicated in so-called 'muthi murders', where people are killed for body parts to be used by witchdoctors, or are killed as a result of umthakathi. Confusion of witchdoctors with traditional healers in the media has resulted in a negative public image of all traditional practitioners.

CUNNINGHAM (1990a) further included plants that hold a purely symbolic value, but, like placebos, are important for the psychosomatic effect. SRIVASTAVA *et al.* (1996) defined medicinal plants as “those that are commonly used in treating and preventing specific ailments and diseases, and that are generally considered to play a beneficial role in healthcare”. The latter encompasses all types of healthcare, an important consideration that surpasses common Western ethnocentric attitudes towards indigenous medicines. For example, SRIVASTAVA *et al.* (1996) suggested that medicinal plants be deemed as such only when medicinal properties are proven by Western research. MARSHALL (1998) defined traditional medicines as plant, animal or mineral material used in treatment of physiological, psychological or other problems, according to a traditional system of the region (materials of plant or animal origin were termed wildlife medicinals). This included use for talismans, ceremonial or religious purposes associated with healing and protection, and for narcotic, stimulant, hallucinogenic or toxic effects. KOKWARO (1995) included charms, amulets, spells and incantations in his definition of traditional medicine. A more encompassing definition of ethnomedicine was presented by FOSTER & ANDERSON (1978 cited in ANYINAM 1995), who described it as the “totality of health, knowledge, values, beliefs and practices of members of a society including all the clinical and nonclinical activities that relate to their health needs”.

NGUBANE (1992) noted that Western and African medical practices differ in four major areas of doctor-patient relationships: communication, preparation of the case history, information about diagnosis, and opinion regarding referral to other practitioners. Although frequently viewed from a Western perspective as ‘alternative’, the approach of African traditional medicine is fundamentally similar to that of Western healthcare (IWU 1993). Indeed, all systems of medicine aim to diagnose and treat ailments, and maintain health in the broadest sense of well being (VAN WYK *et al.* 1997).

However, the most apparent difference between the two is a psychological aspect absent in Western health care. Traditional healthcare systems in southern Africa consider illness as disequilibria in the psychological or social harmony of the patient, manifested as physical or mental symptoms. Healing aims to rectify such imbalances and impurities from the mind and, therefore, the body (HEWSON 1998) and to prevent recurrences of illness (VAN DER GEEST 1997). Western therapy may be described as medical practices and services based on biomedical principles (GESLER 1984, VAN DER GEEST 1997). Such medicine systems differ in the separation of mind and body according to Cartesian principles, and healing aims to correct disease and alleviate physical suffering (HEWSON 1998).

Where Western healthcare is considered an alternative to traditional medicine, facilities are frequently limited and not readily accessible in South Africa. Constraints on the accessibility of Western doctors, clinics and hospitals – particularly in rural areas – include the expense of transport and consultation, travelling

distance and time (CUNNINGHAM 1990a, NGUBANE 1992, MANDER *et al.* 1996). These factors are largely the result of a political history that racially segregated and unevenly distributed healthcare in this country (DAUSKARDT 1990). Where traditional medicine is the only available form of therapy, it fulfils the function of primary healthcare (CUNNINGHAM 1990a). Traditional healers are increasingly recognised by health authorities as important primary caregivers (CUNNINGHAM 1988, MANDER *et al.* 1996, VAN DER GEEST 1997, HEWSON 1998), but there is conflict between practitioners of both systems in rural areas where traditional healers are no longer the only source of healthcare (Pers. comm. HAGUE 2001²). Furthermore, integrated medical services may not be met with a positive response at the community level, as in Ghana where the use of traditional herbal medicines in modern health facilities was considered inappropriate (LE GRAND & WONDERGEM 1990 cited in VAN DER GEEST 1997). Medical pluralism (where a choice exists between different sources of treatment) is typical of most societies, and integration of indigenous and biomedical healthcare is increasingly acknowledged as an effective solution to primary healthcare delivery (GESLER 1984). A broad division exists between Western and traditional medicines in South Africa, but a spectrum of healthcare options (e.g. Western fringe practitioners, pharmaceuticals, faith healers) occur between them (DAUSKARDT 1990).

Change in socio-economic status, stimulated by economic growth, is widely held to be the likely factor to govern a shift in favour of Western medicine throughout Africa. However, this shift has been prevented by economic deterioration in most African countries (CUNNINGHAM 1990b). The majority of regular users of traditional medicine are people without formal education (labourers, domestic workers, retired and unemployed) (KAPLAN 1976 cited in CUNNINGHAM 1988). In KwaZulu-Natal, with one of the highest incidences of poverty in South Africa, low-income groups in both rural and urban areas utilise traditional medicines (MANDER *et al.* 1996).

This trend, however, does not explain the demand for traditional medicines in urban areas of relative affluence, where Western medicine is accessible. For example, in 1983 approximately 40 % of urban black people in Zululand utilised traditional medicines alone or in combination with Western medicine (EDWARDS *et al.* 1983 cited in DAUSKARDT 1990). Similarly, MANDER (1998) reported that 70 % of the population in the city of Durban relied on traditional medicine for nearly half their health needs. Healthcare utilisation is a function of accessibility (GESLER 1984), yet despite accessible Western facilities, traditional medicine has retained its popular status in urban areas. According to MARSHALL (1998), the demand for traditional medicine in South Africa therefore appears to be driven by cultural background, with little influence from education and income levels. In some instances, consultation with a traditional medical practitioner is substantially more expensive than with a Western practitioner (FAKO 1978). Earlier perceptions that African

² Mr Richard Hague, The Valley Trust, KwaZulu-Natal.

traditional healthcare is concentrated in rural areas have yielded to the reality that its service is utilised extensively in urban areas too, regardless of other healthcare facilities (RUWE *et al.* 1996).

It is therefore the cultural importance of traditional medicine in many urban communities that sustains the demand for traditional plant products (CUNNINGHAM 1990a, MANDER *et al.* 1996). Surveys indicate that consumers will continue to use both indigenous and Western healthcare systems in the short term (MANDER 1998) whilst economic upliftment may curtail the reliance on traditional healthcare in the long term (CUNNINGHAM 1990a).

The traditional healthcare sector expanded rapidly in South Africa during the twentieth century, and this trend is expected to continue. In 1909, 754 practising healers were registered under the Native Code of Law in Natal; by 1990, CUNNINGHAM (1988) estimated 12 000 practitioners would be active in KwaZulu-Natal. On a national scale, the Select Committee on Social Services (SCSS) estimated 350 000 traditional practitioners were active in 1998 (SCSS 1998). Compared to 250 000 allopathic medical personnel at the time (SCSS 1998), the importance of traditional medicine in the delivery of primary healthcare is apparent.

Factors affecting this include population growth, slow employment rate, influx of foreigners seeking work, and limited government resources for welfare upliftment (HUNTLEY *et al.* 1989 cited in WILLIAMS *et al.* 2000, MANDER *et al.* 1996). More recently, the AIDS pandemic and international demand for medicinal plant products have also been identified (MANDER 1998). Statistics verify the escalating demand for traditional medicines: in 1977, the World Health Organisation (WHO) estimated up to 80 % of the population in developing countries used traditional healthcare (PENSO 1980). Concurrently, HOLDSTOCK (1978 cited in MANDER 1998) reported up to 80 % of black people in South Africa used traditional medicines and, in 1996, an estimated 60 to 70 % of urban Africans used traditional medicine (MANDER *et al.* 1996). At least 27 million people use traditional medicine in this country, of which six million reside in KwaZulu-Natal (MANDER 1998). Recent data are lacking, but the perception amongst researchers (Pers. comm. CROUCH 2002³, VERMEULEN 2002⁴) and practitioners (Pers. comm. NDLOVU 2001⁵) of traditional healthcare is of continued expansion.

Accordingly, legislation has been introduced to regulate this important source of healthcare in South Africa. Under early South African law, efforts were made to curtail traditional healthcare – viewed as a threat to Western medical professionals – by licensing and prohibiting some forms of practice (DAUSAKARDT

³ Dr Neil Crouch, National Botanical Institute, Durban.

⁴ Dr Wessel Vermeulen, Department of Water Affairs and Forestry, Eastern Cape.

⁵ Mr Elliot Ndlovu, Traditional Medical Practitioner, Pietermaritzburg.

1990, MARSHALL 1998). Registration was made compulsory for herbalists, but the registration of traditional midwives was implemented only in the 1980s (CUNNINGHAM 1988). Despite compulsory registration, Clause 36 of the Medical, Dental and Supplementary Health Services Profession Act of 1974 stated that it was illegal for any registered person to practise in collaboration with a non-registered practitioner, and for a non-registered person to consult in a medical and dental capacity (SPRING 2001). Traditional practitioners were legalised in the former KwaZulu in 1989 (SPRING 2001). Although outlawed by the Suppression of Witchcraft Act (SCSS 1998, SPRING 2001), the practice of traditional healing by diviners (erroneously equated with witchcraft) is now protected by several clauses in the Bill of Rights in the Constitution of 1994. The National Council of Provinces proposed in 1998 that nyangas, sangomas, traditional birth attendants and traditional surgeons be recognised as professionals (SCSS 1998).

Presently, traditional healthcare has received official recognition but government policy on the organisation and regulation of traditional medicine has reached only interim phases, and integration into national mainstream healthcare has not yet been addressed (SAMAYENDE 2001). According to the Medical Scheme Act of 1998, medical schemes are prevented from paying benefits to a medical practitioner who is not legally registered. Medscheme, a body to which more than 40 medical aid companies are affiliated, reported that traditional medical practitioners would need to be registered and accredited by the Health Professions Council, and other holistic healthcare systems recognised, before traditional medicine could be covered by medical aids (SAMAYENDE 2001). Interestingly, organisation of traditional healthcare practitioners was considered necessary, prior to attempting integration of traditional and Western medical systems, in Botswana (FAKO 1978).

Although largely informal, the traditional healthcare sector is structured by various associations, with minimal, if any, support from the state (MARSHALL 1998). In KwaZulu-Natal, The Natal Native Medical Association was formed by licensed herbalists in the Durban area in 1930, but was not recognised by government (CUNNINGHAM 1988). The Natal Parks Board established the Natal Herb and Traditional African Medicines Traders Association (HTA) in 1976, in an effort to reduce over-exploitation of natural resources used for traditional medicines (CUNNINGHAM 1988). In 1997, the KwaZulu-Natal Traditional Healers' Council was established under the auspices of the Inyanga's National Association (INA); affiliation is granted on passing a verbal examination with a minimum of 50 %, and the resulting qualification is approved by the Department of Health (SPRING 2001). This represents the first attempt to unify and control the traditional healthcare profession in the province, and is now referred to as the Interim Council of Traditional Medical Practitioners, until bodies from throughout South Africa merge to form the National Reference Centre for African Traditional Medicines (NRCATM) (SPRING 2001).

On a national level, government approved the Inyanga's National Association (INA) in 1983 (CUNNINGHAM 1988), and MARSHALL (1998) reported 80 000 members of the Traditional Healers Organisation of South Africa. Progressive Primary Health Healers (PPHH), a national organisation to which more than 5 000 traditional practitioners belong, reported that dialogue between government and traditional medical practitioners will be facilitated only by representation in Parliament (SAMAYENDE 2001). Due to the lack of a single national body, difficulty has arisen in democratically communicating the needs of traditional medical practitioners in policies and laws (WYNBERG & SCHUTZE 2001).

Many traditional healers are not members of regulatory bodies such as these, which presents several problems regarding control of the traditional healthcare sector. The demand for traditional medicines has led to an increase in the number of practitioners without formal training (CUNNINGHAM 1988, BYE & DUTTON 1991, NGUBANE 1992) and questionable safety of medicines. Indeed, MANDER (1998) reported that 99 % of traditional healers' patients in one survey wanted medicines to be certified for quality. In order for traditional therapy to effectively fulfil its role as a source of primary healthcare, stricter controls on the practice, availability and administration of medicines are necessary.

Trade in traditional medicines

The problem of regulation is compounded by the commercialisation of the trade in traditional medicine products. Expansion of traditional healthcare has stimulated a lucrative and well-developed commercial trade in traditional medicine products. This trade, although not formally recognised (CUNNINGHAM (1988, 1990a) referred to it as South Africa's 'hidden economy') was thoroughly documented in the 1990s but recent data are not as prolific. Traditional medicines are procured from both flora and fauna in the wild, but 85 % of traditional medicine involves the use of plant extracts (FARNSWORTH 1977 cited in CUNNINGHAM 1990a, MARSHALL 1998). Traditional medicine plants are also an important potential source of plant-based commercial drugs (FARNSWORTH 1977 cited in CUNNINGHAM 1988, MARTIN 1995) and bioprospecting of the South African medicinal flora may yield natural products for the treatment of illnesses common in South Africa (JÄGER *et al.* 2002).

In this country, the indigenous medicinal plant trade is centred in KwaZulu-Natal, where medicine markets supply local healers, and markets elsewhere in South Africa and neighbouring countries (CUNNINGHAM 1988, 1990b, MANDER *et al.* 1996, WILLIAMS 1996, MANDER 1998, MARSHALL 1998, WILLIAMS *et al.* 2000). In 1996, annual turnover from the indigenous plant trade in South Africa was estimated to be R 500 million (MANDER 1998). In 1998, approximately 20 000 tonnes of plant material was

traded in South Africa, conservatively estimated to have an annual market value of between R 270 million per annum (MANDER 1998) and R 1 billion (SCHUSTER CAMPBELL 1998).

In developing countries, medicinal plants are a possible 'bridge' between economic development, affordable healthcare, and sustainable management of biodiversity, yet few countries have the resources for policy, regulation and research necessary to achieve this (SRIVASTAVA *et al.* 1996). In South Africa, economic opportunities presented by local and international trade in medicinal plants, and the essential needs of traditional medicine users, are hinged on the availability of plant material (MANDER *et al.* 1996). The sustainability of medicinal plant resources therefore impacts significantly on several important socio-economic spheres in this country.

Tree products in traditional healthcare

Between 80 000 and 100 000 tree species are known to science, a tenth of which are globally threatened; 17 species are critically endangered, 33 endangered, and 91 vulnerable to extinction (WORLD WILDLIFE FUND (WWF) 1998, GATES 2000). Deforestation is the primary threat to tree species; between 1950 and 1975 alone the world's forested surface area was reduced from 30 % to 12 %, and global deforestation is estimated to continue at a rate of 10 000 trees per minute (MKALI 1988 cited in ANYINAM 1998). The African continent is subject to the highest rate of deforestation in the world: 1 % of the 216 634 000 ha of closed forest area is lost annually (IWU 1993). The South African flora is well known for its richness and diversity of species: the 21 377 recorded species constitute approximately 10 % of the world's plant diversity, of which 10 % are threatened (GOLDRING 1999). This is regarded as the highest concentration of threatened plants in the world (MARSHALL 1998). Estimates of the number of higher plant species in the South African traditional pharmacopoeia range between 700 (MANDER 1998) and 3 000 (VAN WYK *et al.* 1997). Although trees comprise roughly 65 % of the world's medicinal plants, they constitute a small fraction of medicinal plants in South Africa but provide nearly one third of all market produce. Some 130 medicinal species, at least 112 of which are harvested for their bark, come from indigenous forests, which now cover only 0.3% of South Africa (COOPER 1985, CUNNINGHAM 1991, MANDER *et al.* 1997). In South Africa, tree products used medicinally are also procured from savanna, thicket and grassland vegetation.

As well as timber and fuelwood, trees yield numerous economically useful products, referred to under the umbrella term of Non-Timber Forest Products (NTFPs)⁶. These include exudates (e.g. latexes, resins),

⁶ NTFPs include products from shrubs and other plants growing in forests, as well as materials of non-plant origin (honey, fungi, animals) specific to forest habitats.

bark, leaves, fruits, seeds, oils and fibres, that may be used for food, medicines, building materials and a vast array of other purposes. Some tree species yield only one important NTFP but most species are the source of several. This is illustrated by *Adansonia digitata* L. (Bombacaceae) in Africa, the bark of which is used for fibre and rope, the hollow trunk for water storage, the leaves for a lotion, aerial parts and fruits for foodstuffs, fruit husks for fuel and the ash for soap (CANADIAN INTERNATIONAL DEVELOPEMNT AGENCY (CIDA) 1992). In other cases, a tree may yield one NTFP with many purposes, such as the valuable resinous exudates from *Boswellia* spp. (frankincense) and *Commiphora* spp. (myrrh) (both Burseraceae) that are used for fragrance and flavouring agents (COPPEN 1995, BOTANICAL.COM 2002, SURVEY OF ECONOMIC PLANTS FOR ARID AND SEMI-ARID LANDS (SEPASAL) 2002a).

The diversity of NTFPs from trees is indicative of their socio-economic importance, especially to local people dependent on them. The economic value of forests to communities often equates to a significant proportion of the income of rural households (DEPARTMENT OF WATER AFFAIRS AND FORESTRY (DWAF) 1995). Benefits include augmented food sources, subsistence products, income and employment. More recently, ecotourism has become an additional economic opportunity for forest-dependent communities (CIDA 1992). The inherent non-consumptive value and potential of indigenous vegetation in South Africa includes tourism and cultural significance for burial sites (LAWES *et al.* 2000). Although poorly researched and quantified, it is undoubted that NTFPs greatly enhance the potential range of economic activities undertaken on forest estates (VON MALTITZ & GRUNDY 2000).

Tree products used as ingredients in traditional medicines include leaves, bark, roots and exudates and to a lesser extent, fruits and seeds. Material with a long shelf-life (roots, bark, bulbs, seeds and fruits) dominate herbal medicine markets in South Africa, whereas leaves are the most commonly sold plant part in other regions of Africa (CUNNINGHAM 1990b). Bark is the most popular product in South Africa harvested from trees, and comprises at least 27% of the market produce traded annually in KwaZulu-Natal (MANDER 1998). Since the medicinal plant trade in South Africa and neighbouring countries is centred in KwaZulu-Natal (CUNNINGHAM 1988, MANDER *et al.* 1996, MARSHALL 1998, WILLIAMS *et al.* 2000), this may be extrapolated to determine the national trade (up to R 1.35 million in 1998 (MANDER 1998)) in bark products. The extrapolation agrees with WILLIAMS *et al.* (2000) who reported that bark products comprised 25.6 % of plant parts traded on the Witwatersrand in South Africa. Because the majority of South Africans make use of traditional healthcare, bark is fundamental to the traditional pharmacopoeia.

Bark medicines are used in treatments for a diversity of ailments, spanning all levels of healthcare, from first aid to preventative and rehabilitative therapy, and for magical or religious purposes. The popularity of barks, attributable to their medicinal efficacy, may be justified by typically high concentrations of active

constituents (VAN WYK *et al.* 1997). Bark may have been favoured historically over other tree products, as it is readily accessible and availability unaffected by seasons, whereas the leaves, flowers and fruits of trees may not be. It is usually removed using an axe or cane knife (machete), and dried prior to being transported to market traders and shops (MANDER 1998).

In South Africa, medicinal bark products are sold either as partially processed chunks (10-30 cm x 3-10 cm), or processed into chopped and ground products (< 1 mm) (MANDER 1998) that are sometimes sold in mixtures of various plant ingredients (Figure 1.1). A crudely fashioned mortar and pestle, usually made from thick iron piping, is used to grind the material at markets (MANDER 1998). The healer or trader subsequently prepares raw products, typically sold alone and less commonly with other ingredients, for further preparation and self-administration by the patient. Methods of preparation generally aim to facilitate extraction of active principles – the 'power of force' - from the plant material (KOKWARO 1995). Accordingly, bark is usually powdered and extracted prior to use. Liquid preparations such as decoctions and infusions, administered orally or by enema, are used most frequently for internal complaints. For the treatment of external ailments such as injuries and dermatological ailments, powdered bark or ointments are generally used. Bark may also be chewed as a first-aid method of administration, particularly in the treatment of snakebite (KOKWARO 1995). More specialised methods of administration include the application of powdered bark to incisions made by the traditional healer, and the burning of bark to treat spiritual and psychological complaints (e.g. HUTCHINGS *et al.* 1996).

The principal functions of bark are to provide the tree with a protective covering of the stem and roots, and conduct dissolved assimilates in the phloem (ESAU 1977). Protection is primarily mechanical, but bark fulfils a chemically defensive role too. Accordingly, high concentrations of secondary compounds are typical of bark tissues; these have important antiherbivory and antipathogenic properties, and are frequently of medicinal use to man. Because the outermost rhytidome senesces on the tree, it is very difficult to determine the age and storability of bark as it is already dead when harvested and the storage period already commenced (Pers. comm. STAFFORD 20017). However, the phytochemical properties for which crude bark products are used must be stable since they remain in the bark despite prolonged storage periods, both on and off the tree. PUJOL (1990) noted that bark retains its colour and potency, particularly when dried, for "a very long time".

Biologically active phytochemicals may be unique to the bark tissue; among many examples of this is the antibacterial activity indicated by the rootbark of *Bersama abyssinica* Fresen. (Melianthaceae) but not shown by the leaves (TANIGUCHI & KUBO 1993). Other biologically active principles in the bark may be

⁷ Mr Gary Stafford, University of Natal, Pietermaritzburg.

ubiquitous in a plant. For example, the bark and leaves of the popular and critically endangered South African medicinal species *Ocotea bullata* (Burch.) Baill. (Lauraceae) show very similar phytochemical profiles and *in vitro* activity suggestive of anti-inflammatory properties (ZSCHOCKE *et al.* 2000a). Similarly, antibacterial and anti-inflammatory compounds present in the mature bark of another important medicinal species *Warburgia salutaris* (Bertol. f.) Chiov. (Canellaceae) are also present in the twigs and leaves (ZSCHOCKE *et al.* 2000b). At the interspecific level, secondary compounds in bark may be common to members of related taxa, as is the case with *O. bullata* and its medicinal substitutes, *Cryptocarya* spp. (Lauraceae). *In vitro* activity suggestive of anti-inflammatory activity is closely comparable between the genera (ZSCHOCKE & VAN STADEN 2000). Two members of the Anacardiaceae, *Loxostylis alata* Spreng. f. Reichb. and *Smodingium argutum* E. Mey. ex Sond, also show notable analogies in the phytochemical constituents of bark (DREWES *et al.* 1998).



Figure 1.1 (a) Commercialisation of the trade in traditional medicines has established a consumer market for herbalist shops such as this one in Pietermaritzburg. (b) Despite commercialisation, most medicinal plant products are sold in semi-processed form, (c) processed chunks or (d) mixed with other plant products. (e) Packaging is rudimentary

The presence of lichens, lower plants such as bryophytes, and epiphytic higher plants, may influence the phytochemical properties of bark, particularly as some secondary products are unique to lower plants (JÄGER *et al.* 1997). Cyclooxygenase-inhibitory activity *in vitro*, indicative of *in vivo* anti-inflammatory activity, is as potent in some lichen species as that of higher plants used medicinally in KwaZulu-Natal (JÄGER *et al.* 1997).

The medicinal value of bark

Historically, bark has played an important role in indigenous and Western healthcare systems. Although the focus of biomedical research shifted early last century to pure chemistry for pharmaceuticals, natural products research has played an important role in drug discovery (CRAGG *et al.* 1997, McCHESNEY 2001), and a number of significant chemical discoveries were made from bark. It is not surprising, however, that natural products research is directed at herbaceous plants and shrubs, as bark is both difficult to work with and presents problems of supply, whereas soft tissues and aerial parts do not. *

One of the earliest discoveries of a medicinal bark that contributed significantly to modern healthcare was that of *Cinchona* spp. (Rubiaceae). The genus is indigenous to the Andes and was first documented in the 1630s as a cure for malaria by an Augustinian monk in that region (e.g. RAINTREE NUTRITION 2001, BURBA 2002). The bark was initially introduced to European medicine in 1640 and incorporated in the English Pharmacopoeia in 1677. The bark of *Cinchona* spp., of which *C. ledgeriana* Moens ex Trimen and *C. succirubra* Pav. ex Klotzsch are the most potent, was the dominant antimalarial therapy until the active principle, quinine (a quinoline alkaloid), was synthesised in 1944. Thereafter synthetic drugs replaced the bark but quinine remains one of the most-used antimalarial drugs worldwide. Later, quinidine was isolated as the compound responsible for the antiarrhythmic activity for which *Cinchona* spp. are also used. Because attempts to synthesise the latter have been unsuccessful, the demand for quinidine rather than quinine sustains current commercial plantations in Africa (Zaire is the primary supplier), Indonesia, India and South America (RAINTREE NUTRITION 2001, BURBA 2002).

Another early example of a bark medicine to influence biomedical healthcare is that of *Prunus africana* L. (Rosaceae), the single member of the genus native to Africa. Chloroform bark extracts are used in European pharmaceuticals to treat benign prostate enlargement (CUNNINGHAM & MBENKUM 1993, ICRAF ONLINE 2000). The use of *P. africana* bark by Europeans to treat urinary complaints began in the 1700s, as advised by local traditional healers in Natal. Pharmacological activity is ascribed to a synergistic effect of several known and unknown compounds, including phytosterols, pentacyclic triterpenes and ferulic esters (ICRAF ONLINE 2000). A patent of a bark extract made in 1966 by a French entrepreneur is now the

X
property of several European pharmaceutical companies. Today it is one of the most regularly used therapies for prostate enlargement and demands are expected to double or triple within 10 years (ICRAF ONLINE 2000). Bark for export is harvested almost exclusively from wild populations, mostly in Cameroon and Madagascar, at a rate of eight times that of regrowth (ICRAF ONLINE 2000, GEORGE *et al.* 2001).

More recently, Paclitaxel, a compound isolated from the stembark of *Taxus brevifolia* Hort. ex Gord. (Taxaceae) has contributed to biomedical treatment of cancers. According to the United States National Cancer Institute, it is the most significant anticancer agent developed since the 1980s (McCHESNEY 2001).

The important contribution of bark medicines to traditional healthcare in southern Africa is irrefutable, indicated by the demand for bark products in the southern African medicinal plant trade. Phytochemical and pharmacological investigations of medicinal barks have focussed on traditional American and Asian⁸ healthcare; relatively little work has been conducted on South African medicinal plants (GEORGE *et al.* 2001) and even less on barks in particular. However, the traditional use of some South African bark medicines has been substantiated from a scientific perspective.

In contrast to natural products testing, where high throughput bioassay systems screen thousands of phytochemicals at a time, the intent of trials undertaken from an ethnobotanical perspective is largely to rationalise the use of traditional phytomedicines and optimise traditional methods of treatment (DREWES 1999, IWU & GBODOSSOU 2000, FABRICANT & FARNSWORTH 2001, JÄGER *et al.* 2002). Furthermore, such research serves to answer questions about the safety and efficacy of traditional plant medicines that must be answered before traditional remedies may be merged with primary allopathic healthcare (MAHADY 2001). For example, the South African Traditional Medicines Research Group (SATMERC) programme aims to formalise the use of traditional medicines using monographs and, ultimately, a South African Herbal Medicines Pharmacopoeia (SATMERC 2001). The ethnobotanical approach is important, too, as the role of botanical knowledge in ethnopharmacological research serves to introduce a conservation aspect: discoveries of interesting plant compounds are of little use if the species concerned are under threat of extinction (HEDBERG 1993).

Medicinal properties of the more important bark species used in South Africa have been confirmed by such studies. For example, 17 medicinal barks used in KwaZulu-Natal showed promising *in vitro* activity in several bioassays (JÄGER *et al.* 2002). Indeed, as a result of extensive biological screening and isolation of active ingredients, GEORGE *et al.* (2001) noted that the barks of *Ocotea bullata* (Lauraceae) and *Warburgia*

⁸IWU (1993), for example, noted that the study of African medicine has not been taken as seriously nor documented as fully as that of other traditional societies, such as the Chinese.

salutaris (Canellaceae) show potential for development as commercial phytomedicines. Low profile medicinal bark species do not enjoy such research attention, but increased coverage may be expected as demand-related conservation threats escalate.

Whilst the medicinal properties of many bark species are not yet documented, biological activity has been largely confirmed in those that have been investigated. Growing exploitation poses a real and immediate risk to the sustainability and availability of bark medicines in this country. An appreciation of the medicinal values of bark products in South African traditional healthcare is therefore to be expected.

Objectives of the study

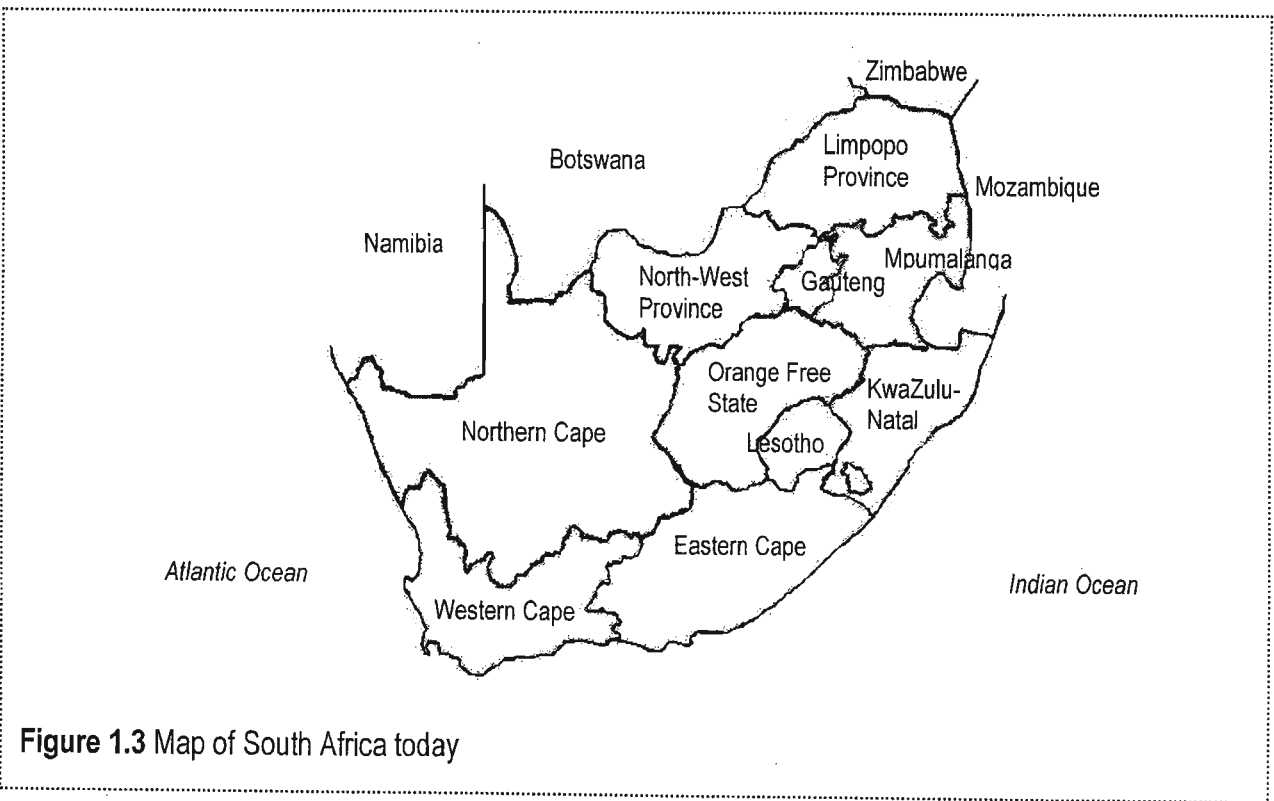
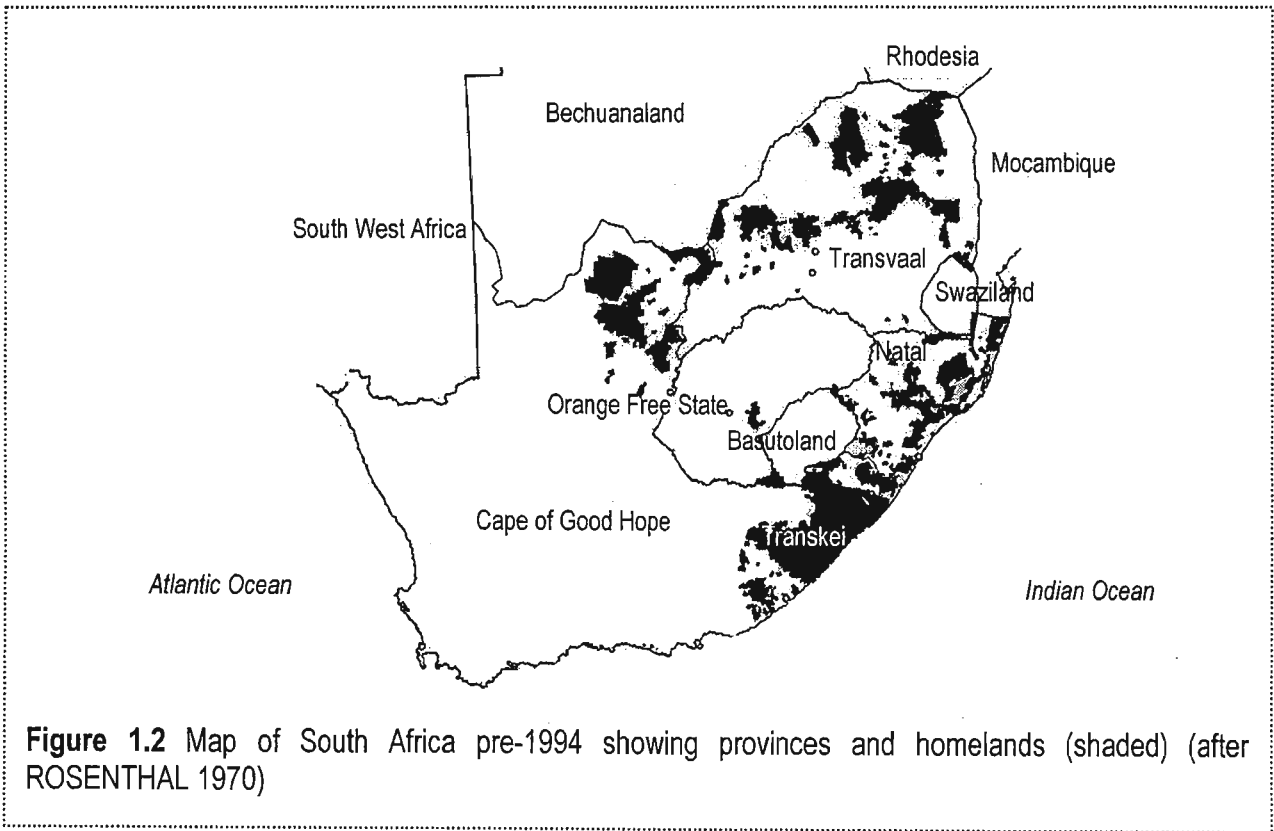
The principal aim of this research project was to provide a definitive account of the role of bark, and the plant species used, in traditional healthcare in KwaZulu-Natal, South Africa.

The project was geographically confined to KwaZulu-Natal (Figures 1.2 and 1.3) because the province represents the epicentre of the medicinal plant trade in South Africa, and traditional healthcare fulfils a primary role for the majority of the population in the province. By concentrating on this region, a thorough account within the available time period was possible. Although bark usage and the dynamics of the traditional healthcare sector in KwaZulu-Natal may be extrapolated to reliably reflect the situation elsewhere in South Africa, it must be cautioned that regional differences in traditional healthcare exist.

An electronic database of plant species used medicinally for their bark in KwaZulu-Natal facilitated assessment of the role of bark in traditional healthcare in the province, as reflected by the literature. This also served to test the reliability of the literature in such an exercise. The database provides a comprehensive source of information relating specifically to the usage and properties of medicinal bark species in KwaZulu-Natal.

Additionally, the research aimed to consider the sustainability of bark resources, and the effects thereof on people-plant interactions associated with the medicinal use of bark in KwaZulu-Natal. The impact of limited plant resources on the integrity of traditional healthcare, and the problem of bark authentication, were considered. Therefore the use of phytochemical fingerprints in the authentication of medicinal bark products was assessed. Eight study species, selected according to their popularity as traditional medicines and difficulties of identification, formed the basis of this assessment. Development of a simple method of authentication for these species was therefore called for, in the context of monitoring the trade in traditional plant medicines and user safety.

By disseminating the findings of this research, the ultimate objective was a contribution to the knowledge and understanding of traditional medicine from a scientific perspective.



Sustainability of bark resources for traditional healthcare in South Africa

Availability of bark resources for traditional healthcare in South Africa

The supply of medicinal plant products to the traditional healthcare sector in South Africa is sourced almost exclusively from natural plant populations in a variety of different habitats. Tree products, notably bark, are harvested principally from the Forest, Savanna, Grassland and Thicket Biomes, on private and communal lands, commercial farms, forestry estates, protected areas and also from neighbouring countries (MANDER 1998).

The Forest Biome

The Forest Biome is the smallest in southern Africa, covering < 0.25 % of the subcontinent. Forests occur as patches, usually < 1 km², the largest being in the Eastern and Western Cape Provinces and KwaZulu-Natal. Patchiness makes forests difficult to conserve as a consequence of island dynamics. Due to high humidity, and fire-tolerant fringe vegetation, forests are seldom penetrated by fire but may be destroyed if fire does occur. Forests in South Africa are restricted to frost-free areas from sea level to 2 100 m asl or higher, with mean annual rainfall of > 525 mm (winter rainfall region) or > 725 mm (summer rainfall region). Forest structure comprises a continuous canopy and multi-layered understory (the ground layer is almost absent due to dense shade), but is not floristically uniform, and may be divided into the Coastal (LUBKE & MCKENZIE 1996a), Afromontane (LUBKE & MCKENZIE 1996b) and Sand (MCKENZIE 1996) forest types, as well as several very limited and specialised forest types (e.g. mangrove forests). All three types occur in KwaZulu-Natal and collectively comprise ca. 0.1 % of the province; the most extensive is the Afromontane type (792 km²). In total, some 649 woody and 636 herbaceous forest species have been recorded (RUTHERFORD & WESTFALL 1986, DEPARTMENT OF WATER AFFAIRS AND FORESTRY (DWA) 1995, LOW & REBELO 1996).

The Savanna Biome

In contrast to the Forest Biome, the Savanna Biome is the largest in southern Africa and occupies 46 % of the subcontinent. Environmental factors such as altitude, frost and rainfall are variable. The major delimiting factors that serve to maintain the characteristic upper woody layer and grass-dominated ground

layer are rainfall, fire and grazing. Whilst summer rainfall is essential for the ground layer, insufficient annual rainfall prevents the upper layer from dominating. Most species are fire-adapted, as fire is the major ecological factor to maintain the grass component. It is also maintained by grazing, although overgrazing may lead to bush encroachment and dominance of the upper layer. The woody shrub-tree layer varies with different vegetation types; in KwaZulu-Natal, Natal Central/Lowveld Bushveld (GRANGER 1996a) is most extensive (18 % of the province), as well as Coastal Bushveld/Grassland (GRANGER *et al.* 1996) (12 %) and Coast-Hinterland Bushveld (GRANGER 1996b) (10.8 %). With the exception of Natal Lowveld Bushveld, of which 20 % is conserved in KwaZulu-Natal, these vegetation types have been extensively transformed in the province (RUTHERFORD & WESTFALL 1986, DWAF 1995, LOW & REBELO 1996).

The Grassland Biome

The Grassland Biome of southern Africa occurs on the central plateau and inland regions of the Eastern Cape Province and KwaZulu-Natal, from sea level to 2 850 m asl. The physiognomy of the Grassland biome includes a single, dominant grass layer associated with sometimes-abundant geophytes (biodiversity is second only to that of the Fynbos biome). Due to frost, fire and grazing, tree establishment is pre-empted, except for occasional localised habitats. The many grassland vegetation types may be categorised as Coastal, Highveld or Mountain types; in KwaZulu-Natal the Mountain types Moist Upland Grassland (BREDENKAMP *et al.* 1996a) and North-Eastern Mountain Grassland (BREDENKAMP *et al.* 1996b) are most extensive. The former (14.6 % of the province) is frequently evident on disturbed or overgrazed sites, indicating the secondary status of many of the representative plant communities, and is poorly conserved in KwaZulu-Natal. In contrast, North-Eastern Mountain Grassland (11.6 %) contains many endemic plant species and, although 4 % occurs within several conservation areas in KwaZulu-Natal, it is threatened primarily by exotic afforestation. Wet Cold Highveld Grassland (BREDENKAMP *et al.* 1996c), occurs at high altitudes (> 1 750 m asl) in the Drakensberg and constitutes 3 % of the province, of which 4.3 % is conserved (RUTHERFORD & WESTFALL 1986, DWAF 1995, LOW & REBELO 1996).

The Thicket Biome

Although there are five different vegetation types within the Thicket Biome, it is represented by only one - Valley Thicket (LUBKE 1996) - in KwaZulu-Natal. It was first recognised as a biome by LUBKE (1996), representing a transitional vegetation type between forest and savanna. Fire-protecting buffer vegetation is evident, but rainfall is too low and physiognomy too simple for inclusion in the Forest Biome. Although it shares floristic components, and is associated with other formal biomes, thicket vegetation is distinguishable by a general lack of strata and herbaceous cover, and may be described as closed, sometimes

impenetrable, shrubland to low forest. Valley Thicket has floristic affinities with Tongoland-Pondoland and Afromontane vegetation, and is notably diverse. It comprises 8.5 % of the province and although contained within some conservation areas (1.5 % in KwaZulu-Natal), is threatened by poor farming practice (RUTHERFORD & WESTFALL 1986, DWAF 1995, LOW & REBELO 1996).

Historic and current perspectives on bark availability

Harvesting pressures on indigenous plants used medicinally in South Africa have intensified as the demand for traditional healthcare has increased. Historically, traditional medical practitioners harvested conservatively to meet the needs of their practice, with limited effect on natural resources (HUTCHINGS 1989b, DAUSKARDT 1990, CUNNINGHAM 1991). Today, however, many traditional practitioners are reliant upon the medicinal plant trade as an indirect source of herbal medicines. The reasons for this are several: urbanisation has removed practitioners from plant resources, population growth has made their practices busier, and exploitation has narrowed access to many medicinal plants. For instance, travel time to the collecting localities of some popular but increasingly scarce species increased by 45 % between 1988 and 1996, whilst others became available exclusively on import from neighbouring countries (MANDER *et al.* 1997).

When traditional medical practitioners do not harvest medicinal plants personally, products are purchased from gatherers, urban retailers, herbalists and market traders. Gatherers are typically women who harvest large volumes of medicinal plant products to be sold directly to traditional medical practitioners, herbalists, retailers, and informal traders, or traded informally themselves (CUNNINGHAM 1988, DAUSKARDT 1990). They occupy the base of the pyramidal trade in traditional plant medicines (CUNNINGHAM 1988) but, because of their precarious socioeconomic situation, cannot afford to practice sustainable collecting methods that may reduce their harvest (JÄGER & VAN STADEN 2000). Although retailers in KwaZulu-Natal are supplied in bulk by gatherers, they are in turn suppliers to many urban traders elsewhere in South Africa (e.g. the Witwatersrand, where 42 % of supplies originate from KwaZulu-Natal (WILLIAMS *et al.* 2000)), and neighbouring countries (MANDER 1998). If a practitioner does not administer medicines, consumers purchase medicinal products from urban retailers, herbalists and market traders (who may harvest their own medicinal plant material or buy in bulk from gatherers and middlemen) (CUNNINGHAM 1988, MANDER *et al.* 1997) for self-medication or on prescription from a practitioner.

Urbanisation and population growth continue to be the principal driving factors of the medicinal plant trade in South Africa. Politics have further influenced the industry's growth, notably abolition of apartheid laws and encouragement by the post-apartheid government of traditional practices (especially in healthcare)

(WILLIAMS 1996). The traditional healthcare sector has metamorphosed from subsistence-level to large-scale commercial industry, supplied by a complex trade network that threatens the very resources on which it is based.

The area of natural vegetation in South Africa has been reduced as a result of urban spread, afforestation and agriculture (CUNNINGHAM 1988). Land use changes effected by the country's political history, including forced relocation of communities to highly populated areas, led to accelerated and pronounced impacts on indigenous vegetation. Over-population of rural areas relative to natural resources are the primary causes of rural poverty in South Africa (ROBERTS 1983 cited in CUNNINGHAM 1988), and as long as large numbers of poor people live in rural under-developed areas, resource harvesting from natural areas may be expected (GELDENHUYS 2002a). OKOJI (2001) suggested that in Nigeria, the rate of forest depletion was a function of conflicts between local people and the early colonial government. KwaZulu-Natal is subject to the highest rates of habitat modification, and largest extent of land transformation, in southern Africa (SCOTT-SHAW 1999).

It is ironic that expansion of the traditional healthcare sector both generates employment (the industry has been important for income generation as well as healthcare delivery in developing urban areas (DAUSKARDT 1990)) but simultaneously threatens the resources on which it depends.

Because forests yield the majority of bark products used in South African traditional healthcare (Chapter 1), and are critically threatened thereby, the following discussion will focus on the Forest Biome.

Climate and fire have historically limited the extent of natural forests in South Africa to ca. 0.2 % (DWAF 1995) to 0.5 % (OWEN & VAN DER ZEL 2000) of the country's land area. Deforestation for agriculture and timber by European settlers in the eighteenth and nineteenth centuries, and forced resettlements in the twentieth century (PALMER & PITMAN 1961, MUIR 1990, COOPER & SWART 1992, DWAF 1995), significantly reduced existing forests and consequently the supply of medicinal forest plants. For example, the discovery of diamonds in Kimberley in 1869 and gold in Johannesburg in 1880 led to extensive exploitation of forests for timber and fuel; by 1888 all accessible forests along the east coast and in Natal were denuded of usable timber (PALMER & PITMAN 1961). KING (1941 cited in CUNNINGHAM 1988) reported that by 1901 exploitable timber (including important species used for traditional medicines) was exhausted from 52 % of indigenous forests in the Transkei region.

In recent times, approximately 4 000 m³ of the annual incremental yield of 700 000 m³ is harvested for timber. This is considered negligible relative to the country's timber demands, but complies with the

important roles of natural forests in environmental protection, biodiversity and ecotourism (DWAF 1995). By way of contrast, an estimated 336 000 m³ of timber was harvested from Eastern Cape forests over a 90-year period from the 1800s, and a dramatic 392 000 m³ from the Karkloof forests of KwaZulu and Natal alone during the 1860s (KING 1941 cited in MUIR 1990, McCracken 1986 cited in MUIR 1990). The need for forest plantations to meet the country's timber demands and reduce harvesting pressure on indigenous forests was recognised in the 1800s and, by 1904, plantations of black wattle [*Acacia mearnsii* De Wild.] constituted 15 % of productive land in Natal (McCracken 1986 cited in MUIR 1990). Afforested plantations in KwaZulu-Natal now constitute 5.7 % of the province's land area (EDWARDS 1997).

It is evident that exploitation for timber and fuel, and agriculture, were the primary agents of early depletion of indigenous forests in South Africa. In combination with other effects, such as penetration by pastoralists' fires and livestock grazing (MUIR 1990), these factors were most influential until the twentieth century. The impact of harvesting for medicinal forest products became apparent later, although some early (unquantified) accounts have been documented. For example, local depletion in Natal of the medicinal species *Mondia whitei* (Hook. f.) Skeels (Periplocaceae) was recorded as early as 1898 (MEDLEY WOOD & EVANS 1898 cited in CUNNINGHAM 1991), and the important medicinal bark species *Ocotea bullata* (Burch.) Baill. was protected by legislation (albeit ineffectual) drafted in 1914 (CUNNINGHAM 1988). Until relatively recently, recorded evidence of the impacts of the medicinal plant trade on biodiversity concentrated on *O. bullata* (CUNNINGHAM 1991) and there are few accounts of other medicinal species prior to that of CUNNINGHAM (1988).

Whilst most forest areas in South Africa are State-owned, the majority of indigenous forests in KwaZulu-Natal are privately owned (COOPER 1985, DWAF 1995). The latter are at risk of rapid and irreversible exploitation, due to landowners' ignorance of management practice (COOPER 1985). Inappropriate management strategies - community property rights, and privatisation - were the cause of forest loss in former homeland areas of KwaZulu, and Natal, respectively; state-owned forests in the region suffered only a 20 % decline between 1880 and 1961 (McCracken 1986 cited in MUIR 1990). By 1880, one third of forests in Natal were destroyed and, by 1980, 75 % of forest reserves proclaimed in 1936 were lost (MUIR 1990). Today, approximately 56 % of the country's indigenous forests occur within demarcated State forests managed by the Department of Water Affairs and Forestry (DWAF), and a larger percentage within conservation areas, although neighbouring communities frequently have traditional-use rights to otherwise protected resources (DWAF 1995, Pers. comm. VERMEULEN 2002¹). Legislation makes provision for licensed resource harvesting for commercial purposes, but also exemption from licensing for private subsistence requirements; controlling unlicensed harvesting for commercial purposes is most

¹ Dr Wessel Vermeulen, Department of Water Affairs and Forestry, Eastern Cape.

problematic to forest conservation in modern times (GELDENHUYS 2002a). In the case of bark, harvesters perceive their livelihood to be illegal because, if caught, they are prosecuted, and forest guards may confiscate it (GELDENHUYS 2002a).

The perceptions of traditional medical practitioners and traders regarding medicinal plant scarcity sometimes differ from current data, as availability to harvesters is influenced by over-exploitation, limited distribution and, importantly, limited accessibility (CUNNINGHAM 1991). The latter is exemplified by the perceived shortage of the exotic bark species *Cinnamomum camphora* (L.) J. Presl. (Lauraceae): the species is a common garden plant in KwaZulu-Natal but therefore inaccessible to bark collectors. In agreement with local extinctions, *Warburgia salutaris* is widely perceived by traditional medical practitioners as very scarce. Early reports of similar depletions of *Mondia whitei* were not reflected by herbalists' perceptions of plant scarcity recorded by CUNNINGHAM (1988). However, comparison of historical and modern data indicates that the majority of medicinal species deemed popular in early records have remained so (CUNNINGHAM 1990a).

In some regions of KwaZulu-Natal, indigenous forest has been reduced by up to 90 % (CUNNINGHAM 1988). MANDER (1998) identified a 70 % reduction in the potentially harvestable area for medicinal products in the Forest Biome (including Sand, Coastal and Afro-montane forest types), and a 60 % reduction in harvestable area of the Grassland, Savanna and Thicket biomes. In the case of forests, poor conservation and selective exploitation of medicinal forest species were found to be responsible, whilst in the other biomes it was attributed to land-use changes and past harvesting pressure on medicinal plants. The potential resources in each biome have therefore been similarly reduced, but as a result of different external pressures. According to MANDER (1998), medicinal species from the Forest, Grassland and Savanna Biomes are equally popular, and the same comparable numbers of species harvested from each (49 % of important trade items nominated by gatherers and traders in Durban markets were forest species and 51 % grassland or savanna species). However, the Forest Biome constitutes an area 61 times smaller than that of the combined Grassland and Savanna Biomes, and its biodiversity is therefore under far greater threat by exploitation. The impact of bark harvesting on the Forest Biome is compounded by the fact that it yields the majority of medicinal bark resources (CUNNINGHAM 1988, MANDER *et al.* 1997). Reduction in harvestable vegetation that was formerly an actual or potential source of medicinal plants has increased the use of remaining areas (CUNNINGHAM 1988).

Summarily, bark resources for traditional healthcare in KwaZulu-Natal and South Africa are available on a very limited basis. Indigenous vegetation, notably forest, which represents the primary source of medicinal bark products, has been severely depleted and is largely under private ownership or legally

protected. To access bark resources is, concomitantly, to commit a crime. However, conservation is critical to protect existing indigenous flora against the growing threats of development and exploitation, not least that of the medicinal plant trade. Ironically, securing the indigenous flora will secure herbal medicines for traditional healthcare. The availability of medicinal bark resources is one of many issues where an effective solution must be found to meet the sometimes-conflicting needs of consumers and conservation.

Harvesting and its effects

The limited availability of bark resources for the traditional healthcare sector, coupled with high consumer demands that drive a lucrative trade in plant medicines, have rendered these resources non-sustainable at the current rate of use. The southern African flora includes 3 689 ethnomedical plant taxa, of which 86 are Red Data Listed (ARNOLD *et al.* 2000 cited in CROUCH 2000), and nine of the ten most-traded medicinal plant species in KwaZulu-Natal are already Red Data Listed (SCOTT-SHAW 1999). The urgency for ways to reduce the impact of traditional healthcare on the South African flora is obvious. Considered from another perspective, reduced availability of plant resources has important effects on the quality of traditional healthcare.

Impacts on resource availability

Agriculture and timber exploitation were symptomatic rather than causative of deeper-rooted socio-environmental problems that resulted in early depletion of indigenous forests in KwaZulu-Natal (MUIR 1990). The effects of harvesting on indigenous plant resources could perhaps be viewed similarly. Over-exploitation for medicinal purposes is seldom the only factor affecting the sustainability of indigenous flora, since land use changes, commercial trade in medicinal flora and many other significant factors together threaten existing resources (CUNNINGHAM 1990a). The current problem of non-sustainable plant resources for traditional medicines therefore needs to be conceptualised and addressed within a multi-faceted approach, including historic segregation of healthcare, socio-economic problems, depleted flora and projected demands. The effects of harvesting on available plant resources are far-reaching: the impact on biodiversity extends in a 'downstream' effect to impact upon communities and, at the individual level, patients. A reduction in the quality of life of those communities and the exaggeration of poverty in rural areas are ultimate consequences (LEWIS & MANDER 2000). Eventually, the loss of potentially valuable genetic resources affects the whole of society (CUNNINGHAM 1991).

The most important factor affecting sustainable medicinal plant usage is the plant part harvested (SHELDON *et al.* 1997). Indiscriminate harvest of medicinal plants from natural vegetation has detrimental

effects on ecosystems and biodiversity, particularly when bark, roots, seeds and flowers (plant parts crucial to growth and reproduction) are harvested (SRIVASTAVA *et al.* 1996). Zulu medicine in KwaZulu-Natal, and traditional medicine throughout South Africa, is dominated by material with a long shelf life: whole plants, bark, and roots or bulbs (CUNNINGHAM 1988). Storability of plant material is important, as lengthy time periods may lapse between harvesting and selling. Plants are, therefore, killed or limited to asexual reproduction by harvesting. In contrast, leaves are the most commonly used plant part in other regions of Africa (CUNNINGHAM 1990a), harvesting of which is less likely to affect plant vigour and reproductive capacity. Differences in plant medicines therefore dictate that problems of sustainability are of greater threat to traditional healthcare in southern Africa than other parts of the continent.

The effects of the trade in traditional medicinal plants are most clearly seen in the ringbarking of tree species that are a source of popular medicinal barks (CUNNINGHAM 1991). The removal of bark may kill trees by effectively interrupting downward phloem translocation. In response, carbohydrate photosynthetic products and growth hormones diffuse from the phloem above the wound to the xylem, and enter the upward transpiration stream, causing a concentration of these compounds in the aerial parts (KOZLOWSKI & PALLARDY 1997). The efficacy of bark removal as a management practice to manipulate flowering and fruiting in economic crops is well documented (for example, partial ringbarking of fruit trees induces early fruiting and reduces vigour). However, the extent and season in which bark removal is conducted may result in overall loss of vigour or death of the tree. Excessive depth and width of bark removal results in slow callus formation in the wound, depletion of carbohydrates in the roots, and eventual root injury and death (KOZLOWSKI & PALLARDY 1997).

Although bark may be harvested without killing the tree, death is usually the outcome of the volume and frequency of bark removal for the traditional medicine trade. It is removed using an axe or cane knife (machete), and usually dried prior to being transported to the market (MANDER 1998). According to CUNNINGHAM (1988) and CUNNINGHAM & MBENKUM (1993), serious bark damage constitutes removal of $\geq 10\%$ of the trunk bark below head height. Extensive bark removal (usually resulting in ringbarking) is the most common harvesting technique used by commercial gatherers, and the stripping of smaller pieces of bark where trees are repeatedly required for low-volume harvests (CUNNINGHAM 1990a). Thick bark from the main trunk of mature trees is preferred (MANDER 1998). Initially, the trunk is stripped to a maximum height of 3 m, but when bark is scarce, ladders are built to access bark in the crown of the tree and branches, or entire trees are felled (CUNNINGHAM 1988), or neighbouring trees felled on to standing trees to access the upper crown (GELDENHUYS 2002a). Wastage is tremendous if the tree is killed by bark stripping on the trunk, before bark on the upper portion of the tree is utilised (CUNNINGHAM 1988). GELDENHUYS (2002a) reported that some *Ocotea bullata* trees in forests of the Umzimkulu District of

KwaZulu-Natal were debarked to a height of 12 m above ground level. CUNNINGHAM (1991) noted that, in the case of *Warburgia salutaris* (Bertol. f.) Chiov. (Cannellaceae), bark is harvested even when partially regrown, until both aerial parts and roots are entirely debarked.

Commercial gatherers either select forests with a high density of a few species, or high diversity but low species density, to maximise their income. This extensive species selective exploitation has a marked effect on forest structure, as the rate of canopy gap formation exceeds that caused by natural disturbance (CUNNINGHAM 1988). The effects of selective bark harvesting on forest structure are compounded by the methods used. Bark harvesting is typically concentrated in sites accessible by vehicle. LA COCK & BRIERS (1992) noted that in Tootabie Nature Reserve (Eastern Cape Province) bark harvesting was restricted to trees in a site adjacent to a parking area. However, continued harvesting pressure on the site was expected to induce harvesting in less accessible areas of the reserve. In KwaZulu-Natal, persistent harvesting of forest products such as bark has resulted in the complete disappearance of large forests in some areas (DWAFF 1995).

Non-sustainable harvesting for the traditional medicine trade in South Africa, and indeed throughout the continent, has the highest impact on popular, slow growing and slow reproducing species with specific habitat requirements and a limited distribution (CUNNINGHAM 1990a). Many tree species used for their bark qualify as such; a narrow margin exists between sustainable use and over-exploitation (CUNNINGHAM 1991), which requires intensive management efforts to be maintained. In contrast to r-selected species (high reproductive output, short generation periods and highly dispersive or long-lived propagules), K-selected trees are more susceptible to over-exploitation due to their slow growth-rates and long periods required to reach reproductive maturity (MUIR 1990).

The exploitation of any non-timber forest resource produces a measurable impact on the structure and dynamics of the tree populations (PETERS 1994). Of the products obtained from trees, the removal of bark is most likely to have immediate and detrimental effects on individuals and populations. Indeed, a comparison of harvesting responses in *Barringtonia racemosa* Roxb. (Myrtaceae) and *Warburgia salutaris* showed that removal of the plentiful fruits of *B. racemosa* for traditional medicines has little effect but *W. salutaris* is critically endangered as a result of bark harvesting (CUNNINGHAM 1991).

The impact of traditional healthcare on the South African flora is unlikely to abate soon. Current trends indicate that the expected increase in the demand for traditional medicines in this country is indeed occurring. Under these circumstances, the problems of limited and non-sustainable medicinal bark resources, providing inadequate supply to the traditional medicine trade, are set to intensify.

Impacts on traditional healthcare

Limited and non-sustainable availability of bark resources have had significant, and often negative, implications for traditional healthcare in South Africa. Whilst these problems have a ripple effect through the biophysical, economic and social environments, the immediate consequences affect patients of traditional healthcare.

CUNNINGHAM (1990a) noted that the species-specific demand for traditional plant medicines means that alternatives are not easily provided due to the plants' particular characteristics, their symbolism, or the form in which they are taken. However, indigenous medicine – like any profession – is evolving as the supply and demand dynamic changes (MANDER 1998). Resource availability is fundamental in motivating such changes.

There is growing awareness among traditional medical practitioners and other role players in the medicinal plant trade of 'generic' products being substituted for rare medicines, safely or not (Pers. comm. NDLOVU 2001²). Formerly common medicinal products are now included only in more expensive 'special' mixes. For example, the bark of *Curtisia dentata* (Burm. f.) C.A. Sm. (Cornaceae) is found only in 'special' 'ikhabulo' whereas it was once included in 'ordinary' mixes (CUNNINGHAM 1988). Some indigenous plants that have become scarce on local markets are now substituted or replaced by plant products imported to Durban from as far away as India (WILLIAMS 1996), and increasingly from neighbouring countries (e.g. *Warburgia salutaris*, *Acacia xanthophloea* Benth.) (CUNNINGHAM 1988, MANDER *et al.* 1996, 1997, WILLIAMS 1996, WILLIAMS *et al.* 2000). ANYINAM (1998) noted that, as a result of limited availability, freshly prepared herbal medicines are increasingly replaced by different ones, notably ingredients in powdered form, which may be stored for longer periods without spoilage or losing their potency. Adulteration or substitution of animal-derived medicinal products is common practice in the traditional medicine trade³ (MARSHALL 1998). A high proportion of fats, which are among the most popular animal products traded in KwaZulu-Natal, are adulterated with false ingredients, yet consumers believe they are purchasing a genuine product (MARSHALL 1998).

Inevitably, alternative products become available at lower prices than rare, expensive ones (price increases are the result of demand exceeding supply (MANDER *et al.* 1996)). An unusual example is the substitution of *Warburgia salutaris* bark with that of the exotic *Calamus* sp. (Palmae) (CUNNINGHAM 1988).

² Mr Elliot Ndlovu, Traditional Medical Practitioner, Pietermaritzburg.

³ In South Africa, fewer animal species are used, and in lower quantities, than plant species: animal products are employed almost exclusively for symbolic or magical purposes (CUNNINGHAM 1991), whereas plants are used routinely.

The use of generic products from within the same plant family is less puzzling, for example the substitution of *Ocotea bullata* bark with that of either *Cryptocarya latifolia* Sond., *C. myrtifolia* Stapf. or the exotic *Cinnamomum camphora* (L.) J. Presl., all of which are members of the Lauraceae and share a similar aromatic odour. However, cost alone cannot be considered a predictor for the use of alternative species, since wholesale prices remain significantly lower than retail prices, and the latter are generally inelastic (MANDER 1998). Availability of rare material from wholesalers is more likely to influence substitution or adulteration of bark products. Although prices may remain relatively constant, substantial differences in the cost of products have been noted between markets (e.g. BOTHA *et al.* (2001) reported that one medicinal plant, *Alepidea amatymbica* Eckl. & Zeyh. (Apiaceae), cost between R 20/kg and R 1 750/kg at markets in Mpumalanga Province and Northern Province).

Similar species or 'mock-ups' are substituted for scarce ingredients in the case of mythical plants: *Mondia whitei* roots are substituted with the exotic *Cinnamomum zeylanicum* (Burch.) Baill. (CUNNINGHAM 1988). Perhaps the most obvious example of changes in traditional medicines is the availability of patent remedies and pharmaceutical medicines at traditional medicine stores, where plant remedies for common complaints are no longer readily available (CUNNINGHAM 1988).

Yet another factor affecting patient safety, as plant resources become scarce, is the quality of plant medicines. Barks used in traditional medicines may vary in quality and efficacy with age of harvested material (immature bark may not contain the same concentrations of secondary metabolites), shelf life, rates of degradation and post-harvest period. Because trade chains are lengthy and poorly organised, wastage and deterioration of bark products occur in transit from resource areas to markets, where conflicts may arise regarding product value (GELDENHUYS 2002a). Determination of bark shelf life is made difficult because the rhytidome is dead prior to harvesting, and the time since senescence on the tree cannot be determined. Perhaps the only reasonable predictor of storage effects on bark is that the phytochemical properties for which crude bark products are used must be stable, since they remain in senesced bark despite prolonged 'storage' on the tree, and in storage after harvesting (Pers. comm. STAFFORD 2001⁴). MANDER *et al.* (1997) found that traditional healers continue to employ certain plant parts, despite reduced maturity and size of material, as the use of other plant parts of the same species is in many cases unacceptable.

The consumer is reliant upon the person from whom medicines are purchased for quality control. The limited availability and non-sustainability of bark resources, and resultant effects on the quality and integrity of traditional bark medicines, jeopardise patient safety.

⁴ Mr Gary Stafford, University of Natal, Pietermaritzburg.

Reversing non-sustainability

Sustainability broadly refers to the use of resources to meet present needs, without compromising the ability of future generations to meet their own needs. Natural resources cannot meet current, nor foreseeable, demands for many medicinal plant products in South Africa. Whilst conservation of the South African flora is paramount, medicinal plant propagation and cultivation, strategic management and plant part substitution are possible alternatives to natural resources.

Traditional management for sustainability

The supply of tree products is not a problem intrinsic to traditional healthcare. Like most ethnomedical systems, South African traditional healthcare is intricately linked to natural resources within a cultural worldview that values all elements of the landscape (ANYINAM 1998). Prior to commercialisation of traditional medicine, a variety of traditional management practices secured sustainability of tree resources. Throughout Africa, trees are conserved for their shade and edible fruits, and – indirectly – medicinal products (CUNNINGHAM 1990a). The cultural value of plants, especially trees, in maintaining a relationship with the ancestors makes them crucial for the reinforcement of tradition (FOX 2002). Protection of vegetation (natural or cultivated) at burial sites is common, and many beliefs and taboos associated with plant collection may be interpreted as conservation measures (CUNNINGHAM 1990a, VAN WYK *et al.* 1997, ETKIN 1998). For example, bark used in therapy of renal ailments is sometimes only harvested from the eastern and western sides of the tree, symbolic of the kidneys, thereby preventing ringbarking (VAN WYK *et al.* 1997). The eastern- and western-facing bark may also be utilised for its symbolism of sunrise and sunset (Pers. comm. NDLOVU 2001). In North America, it is widely believed that bark harvested from the sunny side of *Prunus virginiana* L. (Rosaceae) trees is more potent than shaded bark (SHELDON *et al.* 1997).

Purposeful conservation measures are traditionally implemented by community leaders and enforced by community headmen and policemen (CUNNINGHAM 1990a). Customary law historically dictated patterns of land tenure and resource use in communities, but involvement of the commercial sector in medicinal plant harvesting has altered customary practices (VORSTER 1999, DWAF 1995). According to CUNNINGHAM (2001) habitat or resource conservation is implemented when three criteria are met: the subject is valued, human impact threatens this value, and social or political conservation controls are enforceable, whilst MAPHALA & CLARKE (1994) stated that the effectiveness of customary rules and taboos depends on the strength and authority of the traditional leaders. Socio-economic factors such as development and commercialisation have significantly eroded cultural principles (ETKIN 1998).

An illustration of the implementation of customary law is the prohibition of hunting, cutting of saplings for construction, and the collection of fuelwood in Dwesa and Manubi forests (Transkei region) imposed on the Gcaleka tribe by their chief to conserve such resources (COOPER & SWART 1992). In Sihangwane sand forest (spanning the border between South Africa and Mozambique) the utilisation and harvesting of wood resources are governed by traditional laws and controls, entrusted to the chief and delegated to local headmen in the region (LEWIS & MANDER 2000). In their study, LEWIS & MANDER (2000) noted that although one rule stated that only dried, moribund material may be harvested from the forest, and despite rules being familiar to the community, there was evidence of living trees being felled and allowed to dry. In the Gokwe District of Zimbabwe, customary beliefs (e.g. threat of illness, lightning strikes) are implemented to govern communities, and supported by fines (LEWIS & MANDER 2000). Because they have no legal power in Zimbabwe, chiefs rely entirely on community support to apply customary legislation, and tribal courts to enforce rules of natural resource management. In South Africa, the power of enforcing customary law rests with Local Government (LEWIS & MANDER 2000).

In recent times, the role of customary principles has been promoted as an aspect of community forestry, where forest-dependent communities are encouraged to manage the resources on which they depend, in conjunction with governmental and non-governmental agencies (FORD FOUNDATION 1998). Social forestry includes many different management programmes that involve community participation in their design and implementation, such as agroforestry, community planting, woodlots and woodland management by rural people, and tree planting in urban and peri-urban areas (DWAF 1995). Community forestry is applied to satisfy local economic, social and environmental needs, and rehabilitation or economic development associated with social forestry practices may help to meet the consumer needs of participating communities (DWAF 1995, LEWIS & MANDER 2000).

International conventions relating to forests and forestry, such as the Rio Declaration of 1992 and Agenda 21, were developed largely to address issues relevant to forest-rich countries (e.g. Brazil, Indonesia) where forest protection and management are prominent on national and international agendas (DWAF 1995). These conventions are not equally relevant to a forest-poor country such as South Africa, but influence international trade and necessitate obligatory compliance with formal conventions, customary international law, and 'soft' international law (where principles have gained widespread moral and political acceptance, such as the norms contained within the Rio Declaration) (DWAF 1995). One of the key goals of community forestry is the long-term conservation of forest resources (FORD FOUNDATION 1998), and it is increasingly adopted throughout the world as a sustainable management option that also benefits forest-dependent communities. Benefits include legal forest access and an official, sanctioned identity for

communities, increased forest productivity, and resource sharing with government (FORD FOUNDATION 1998). The principle has been applied extensively in Asia, South America and Africa.

The long history of silvicultural research throughout arid and semi-arid Africa has resulted in a wealth of knowledge pertaining to exotic forestry in the region, but minimal success in indigenous forest management (ETKIN 1998, FRIES & HEERMANS 2002). In southern Africa, the social forestry approach has been tested in numerous projects with successful and unsuccessful outcomes (the latter most commonly due to lack of community participation in planning and implementation (DWAF 1997)). The presence of a stakeholder in a community, and traditionally controlled resources use, raises the chance of successful conservation at the community level (BALACHANDER 2001). Indeed, the aim to secure "co-operation" of local people, rather than their central engagement in social forestry, has led to the failure of many such programmes in Africa (ETKIN 1998). In Bophutatswana and KwaZulu-Natal, demarcated and proclaimed resource management areas have been allocated to communities, and jointly managed with a conservation authority as access-restricted game reserves. Community members share equitable access to income and land resources (e.g. wood, thatching materials and meat) (DWAF 1995). In Sihangwane forest, community forestry intends to limit destructive timber harvesting (LEWIS & MANDER 1998). In Zimbabwe, it has been implemented for sustainable fuelwood harvesting from indigenous woodlands (MARUZANE & CUTLER 2000).

Whilst community involvement in the management of subsistence resources is sometimes considered a final resort (KYLE 2001) to sustainable conservation of indigenous forests, success is largely dependent upon the participation of rural people (GELDENHUYS 2000). Participatory Forest Management (PFM) is the cornerstone on which DWAF now initiate policy for sustainable forest use and conservation of State-owned forests in South Africa, whereas in the past management focussed on sustainable timber harvesting (Pers. comm. VERMEULEN 2002). Accordingly, the role of community forestry in addressing sustainable development will become increasingly important in South Africa.

Preventative measures

Conservation efforts in communities and areas protected by legislation are now frequently disregarded because of the lucrative demand for commercial harvesting (CUNNINGHAM 1990a). Despite its protected status, the popular bark species *Warburgia salutaris* is extremely rare in KwaZulu-Natal, and extinct even within the boundaries of areas such as Hluhluwe-Umfolozi (MACDONALD 1984, MANDER *et al.* 1996). Use of natural resources will, in many regions of southern Africa, take place irrespective of whether it is permissible or not (DZEREFOS 1999). Bark harvesting as such is not necessarily illegal, but unlicensed and

uncontrolled bark harvesting, especially by commercial operators, is (GELDENHUYS 2002a). Importantly, it is therefore not so much a matter of 'legalising' commercial bark harvesting, but finding ways of controlling it to ensure sustainable methods (GELDENHUYS 2002a).

Since eight out of ten of the most-traded plant species in KwaZulu-Natal are banned from harvest or purchase without permits (MARSHALL 1998), implementation of conservation measures has not been successful in the past. Legislation protecting and regulating the use of plant species is generally less stringent than for animal species⁵, non-existent, or people are ignorant thereof (MARSHALL 1998). Neither policy nor legislation can be effective in sustainable management without physical reserve management (HALL 1983 cited in MUIR 1990). However, conservation policies that relied heavily on law enforcement have proved largely ineffectual and politically non-sustainable in South Africa (MUIR 1990) and policing remains a common approach to conservation in this country (GELDENHUYS 2002a).

Management strategies to prevent uncontrolled bark harvesting at Tootabie Nature Reserve (Eastern Cape Province), when bark harvesting was discovered there, included fencing-off of concealed parking areas, regular patrolling, and monitoring of further harvesting (LA COCK & BRIERS 1992). CUNNINGHAM (1988) used a seven-point scale to assess bark damage in the field, based on the estimated percentage of bark removed below head height. GELDENHUYS (2002a) assessed crown condition of debarked trees according to a six-point scale. Preventative measures against bark harvesting are increasingly drastic: bark removal may be effectively discouraged by barbed wire wrapped around the tree trunk, or the bark painted with a dilute emulsion of water-based coloured PVC paint. This practice renders the bark unusable for medicinal purposes, apparently without affecting tree vigour (CREIG 1984). Ironically, graffiti have also been shown to protect trees against bark harvesters (CREIG 1984).

Management for sustainability

Protected area management in South Africa today is faced with reconciling two previously opposing and mutually exclusive activities: conservation and natural resource utilisation (DZEREFOS 1999).

An island-like pattern of forest patches is evident in KwaZulu-Natal (COOPER 1985); because relatively resource-poor grasslands often surround these patches, they are the foci of exploitation pressure from local human populations (MUIR 1990). The ratio of forest area to local population size may influence harvesting pressure, rate of forest decline and conversion to simplified vegetation forms (MUIR 1990).

⁵ Although most traditional medicines are plant-based, and under greater threat of medicinal exploitation, high-profile fauna (e.g. rhinoceros) have received more conservation attention in recent years (MARSHALL 1998).

Irreversible forest loss is not only catastrophic for biodiversity, but has critical outcomes for the people whose livelihoods depend on them. The southern African flora is being actively bioprospected (an indication of its economic potential) (JÄGER *et al.* 2002) and the non-sustainable demand for ethnomedical plants has already resulted in local extinctions (CROUCH 2000). Since medicinal plants are of greater importance in countries where traditional healthcare is a primary source of therapy (PENSO 1980), forest loss has significant impacts on traditional medicines.

Sustainable harvesting of bark, roots and whole plants for herbal medicines is theoretically possible. However, the possibility is reliant on resolute management that depends on intensive financial and manpower resources that are unlikely to be found in most African countries (CUNNINGHAM 1990a). Furthermore, a lack of published data on biomass, primary production and demography of southern African indigenous plants, and the number of species involved, largely pre-empt determination of sustainable medicinal plant harvesting in the region (CUNNINGHAM 1991). Management potential of bark as a Non-Timber Forest Product (NTFP) is significantly lower than for other tree products such as exudates and leaves because sustainable volumes of bark removal are delicately balanced and regeneration is slow (PETERS 1994). In the short term, management prescriptions based on current knowledge of sustainable harvesting levels and user needs should be implemented, and amended as information becomes available (Pers. comm. VERMEULEN 2002).

Coppicing ability and the vulnerability of trees to the effects of bark removal are important attributes that vary with the physiology (CUNNINGHAM 1991), ecology and taxonomy of different species, and may facilitate effective management for continual bark harvesting. Some indigenous trees used for traditional medicine products are extremely sensitive to bark removal (for example *Faurea macnaughtonii* Phill. (Proteaceae) and *Podocarpus henkellii* Stapf. ex. Dallim, & Jacks (Podocarpaceae)), whilst others such as *Warburgia salutaris* and *Nuxia floribunda* (Hook. f.) Kalkm. (Rosaceae), and some latex producing *Ficus* species, such as *Ficus natalensis* Hochst. (Moraceae), are able to withstand complete bark removal (CUNNINGHAM & MBENKUM 1993).

Examples of post harvest management of trees to promote bark regrowth include the wrapping of the trunk of *Ficus natalensis* with banana leaves in Uganda (Pers. comm. BYARUGABA to PRENDERGAST 1999⁶) and a similar application with plastic for *Eucommia* sp. (Eucommiaceae) in China (Pers. comm. ZHANG to PRENDERGAST 2000⁷). Bark production may also occur on new shoots. *Cinchona* spp. (Rubiaceae), cultivated for their quinine-containing bark since the mid-nineteenth century, are felled for

⁶ Mr Dominic Byarugaba to Dr Hew Prendergast, Royal Botanic Gardens, Kew.

⁷ Mr Bengang Zhang to Dr Hew Prendergast, Royal Botanic Gardens, Kew.

complete bark removal and allowed to coppice. According to the European pharmaceutical companies for which *Prunus africana* (Hook. f.) Kalkm. (Rosaceae) bark is harvested in Cameroon, the recommended method is to remove bark from opposite quarters of the tree trunk from 35 cm above ground level to the first branch. Seven or eight years later, the bark regrows to allow similar harvesting of the alternate quarters (CUNNINGHAM & MBENKUM 1993, ICRAF ONLINE 2000). Removal of narrow, vertical bark strips is generally less destructive than broad horizontal strips that risk ringbarking (GELDENHUYS 2002a).

Vulnerability to exploitation and coppicing ability are primarily determined by a species' dominant reproductive system (sexual or vegetative), which in turn is linked to ecological adaptation. Ecological factors such as frequency of fire may therefore influence reproductive mechanisms, and, in turn, coppice production. Patterns in coppicing ability could apply to vegetation types or biomes, although populations within a species may occupy different points on the r-K continuum as a result of genetic variation (GRIME 1979 cited in MUIR 1990). Besides different morphological traits, some populations of *Ocotea bullata* do not show vigorous basal coppice whilst other populations do (GELDENHUYS 2002a). SHACKLETON (2000) found that in 12 indigenous tree species cutting height and stump surface area were significant predictors of coppice proliferation. MARUZANE & CUTLER (2000) reported that six indigenous woodland species in Zimbabwe showed more prolific coppice production when felled at ground level than at the conventional height of approximately 1 m. Pollarding and allowing the apical bud to persist on the tree were found to increase regrowth for browse material (MARUZANE & CUTLER 2000). *O. bullata* and *Curtisia dentata* coppice readily from debarked wounds or the stem base, but *Rapanea melanophloeos* (L.) Mez. (Myrsinaceae) and *Cryptocarya myrtifolia* Stapf (Lauraceae) do not (GELDENHUYS 2002a). Felling of unhealthy bark-stripped trees for timber usually results in vigorous coppice production from the stumps of *O. bullata* and is a good management strategy for sustainable resource use of both timber and medicinal bark. The number of trees felled would be reduced as a consequence of using each tree for its bark, timber and branch wood for carving (GELDENHUYS 2002a).

Populations of species with the ability to coppice prolifically are not necessarily more resistant to harvesting, as some species that reproduce sexually rather than vegetatively (and hence coppice poorly) show parallel resilience to similar levels of utilisation (MUIR 1990). Ecologically, coppice production may be disadvantageous to a population where multistemmed individuals in a stand are more conspicuous (and therefore harvested first) than single-stemmed individuals occurring at the same density, and a point may be reached where asexual reproduction is "abandoned" by the plants in favour of seedling establishment (MUIR 1990). For prized medicinal bark species, however, it is common for the largest individual in a stand to be sought and harvested selectively (CUNNINGHAM & MBENKUM 1993). The reactions of many plants to intervention – such as bark removal and felling – may be species-specific or widely applicable, but

knowledge about them may be largely scattered in horticultural literature or among the wealth of unwritten indigenous knowledge (GRACE *et al.* 2002b).

Continual bark removal will cause death even where coppice production is prolific, as plants are debarked when immature (CUNNINGHAM 1988), wound healing impaired, and general vigour compromised. The obvious impact of additional harvesting pressure, in the form of harvesting (rootbark and roots are common medicinal ingredients) and herbivory, on vegetative regeneration and subsequent seed set may or may not differ between species. Despite the ability to coppice, species with restricted distributions are more susceptible to harvesting pressure at the population level. MUIR (1990) noted that whilst *Dombeya cymosa* Harv. (Sterculiaceae) and *Ptaeroxylon obliquum* (Thunb.) Radlk. (Ptaeroxycaceae) both show good coppice production (70 % and 75 % of felled trees) respectively, restricted distributions predisposed existing populations to severe damage caused by pole cutting. Similarly, widespread but uncommon species with good coppicing potential, such as *Ochna arborea* Burch ex DC. (Ochnaceae) (MUIR 1990), cannot overcome harvesting pressures. Therefore whilst coppicing ability influences vegetative regeneration in response to harvesting, reduced seed set as a result of overexploitation may impact strongly on population structure nonetheless. It is generally accepted that relationships exist between resource stock or population size and sustainable harvesting rates. Low sustainable yields are expected from low stocks, particularly when the resource is slow growing (CUNNINGHAM 1991). Sustainable bark harvesting should be based on natural turnover rates and wounding responses, but these attributes are largely unknown (GELDENHUYS 2002a). For example, SHACKLETON (2001) noted that knowledge of management of coppice dynamics of indigenous trees might help to increase regrowth rates and/or the number of coppice shoots for fuelwood. Thus, sustained availability of both fuelwood and medicinal bark may be simultaneously achieved.

Ironically, misguided conservation of indigenous forests may similarly impact upon forest regeneration or exaggerate the effects of harvesting damage. There are numerous anecdotal reports, for example, of the absence of important economic species' seedlings in protected forests in KwaZulu-Natal (e.g. MACDONALD 1984, CUNNINGHAM 1988, MUIR 1990, GELDENHUYS 2000). GELDENHUYS (2000) noted that whilst seedlings of *O.bullata*, *Podocarpus falcatus* (Thunb.) R. Br. Ex Mirb. and *Rapanea melanophloeos* were absent from a forest patch near Umtata (Eastern Cape Province), they were prolific in an adjacent afforested plantation!

Of urgent importance, therefore, in the conservation of tree species used for bark products (and indeed for other economic purposes, such as fuelwood and timber) is an understanding of forest dynamics, species' ability to withstand harvesting pressure, and of their regeneration responses (see Table 2.1 for the

paucity of information about ten popular bark species in KwaZulu-Natal). Such information would assist in the selection of appropriate management practices for individual trees, and natural or cultivated populations.

Alternatives to harvesting from the wild

In South Africa, conserved areas total < 6 % of the country's surface area, but 10 % of our plants are threatened (LOW & REBELO 1996). Therefore not all our flora can be conserved *in situ* within protected areas. The demand for forest products cannot be met by the conservation of natural resources alone, and alternatives to harvesting them are needed.

Sustainable supply of grassland, savanna and thicket tree species (e.g. *Acacia* Mill. spp., *Albizia adianthifolia* (Schumach.) W. Wight (Mimosaceae), *Cussonia spicata* Thunb. (Araliaceae)) may be achieved through intensive management, as relatively large populations are likely to remain on grazing land of commercial livestock farms in the future (MANDER 1998). However, cultivation of forest species is necessary in order to alleviate harvesting pressure and sustain biodiversity in the remaining forest fragments of South Africa (MANDER 1998). The need to cultivate popular indigenous plants was identified by Gerstner nearly 60 years ago (MANDER *et al.* 1996), and highlighted thereafter by a number of workers (e.g. CUNNINGHAM 1988, 1990a, WILLIAMS 1996 and JÄGER & VAN STADEN 2000). Since then, commercial cultivation of indigenous trees has been largely neglected due to lack of farmers' understanding of marketing and cultivation economics, although cultivation trials have shown good potential for meeting consumer demands, and lessening the effects of the trade on biodiversity (MANDER *et al.* 1996).

The use of cultivated plants in traditional medicine not only alleviates pressures on residual populations, but facilitates standardisation and increases safety, as inconsistencies in the quality and composition (due to genotypic and phenotypic variation)⁸ are reduced, probabilities of misidentification and adulteration are lowered, and yields raised by management practice (WORLD HEALTH ORGANISATION (WHO), WORLD CONSERVATION UNION (IUCN) & WORLD WILDLIFE FUND (WWF) 1993). For example, *Taxus brevifolia* Hort. ex Gord. (Taxaceae), the bark of which is commercially harvested for its anti-cancer principles (the bark of 10 trees is required to treat one patient), is now sourced from high-yielding cultivated hedges (GATES 2000).

⁸ A study of phytochemical constituents from five *Ocotea bullata* provenances in South Africa showed notable differences that may affect their medical effects, but the variation was not related to observed genetic variation between the populations (GELDENHUYS 2002a).

Table 2.1 Trade and conservation of ten popular bark species (in order of demand) in KwaZulu-Natal (KZN), South Africa. References are cited in footnotes.

Species	Biome ¹	Conservation status in KwaZulu-Natal	Harvesting response	Urban wholesale price	Annual trade volume
<i>Ocotea bullata</i> (Burch.) Baill. (LAURACEAE)	Forest	Declining and vulnerable to extinction ³ ; protected ⁴ .	Will coppice and recoppice vigorously ³ , but not after heavy damage ⁶ . Coppice shoots are susceptible to browsing ⁹ .	R 2.89/kg in KZN ² , R 500/kg in Mpumalanga Province ¹⁰	25.3 t ²
<i>Warburgia salutaris</i> (Bertol. f.) Chiov. (CANNELACEAE)	Forest, Grassland	Endangered, protected, and globally vulnerable to extinction ^{4,5} .	May show complete regrowth after ringbarking, and vigorous coppice ³ . Prolific root suckers develop in response to mild root damage ⁷ .	R 4.44/kg in KZN ² , R 1250 in Northern Province ¹⁰ , R 1012 in Mpumalanga Province ¹⁰	17.2 t ²
<i>Curtisia dentata</i> (Burm. f.) Chiov. (CORNACEAE)	Forest	Vulnerable and declining ³ ; conservation-dependant and protected ⁴ .	Produces vigorous coppice ³ but susceptible to browsing ⁹ .	R 30/bag* ³ , R 2.22/kg ² in KZN	23.9 t ²
<i>Sclerocarya birrea</i> (A. Rich.) Hochst. (ANACARDIACEAE)	Grassland	Not threatened.	No data.	No data.	No data.
<i>Acacia xanthophloea</i> Benth. (FABACEAE – MIMOSACEAE)	Grassland	Not threatened.	No data.	R 10/bag* ³	153 bags* ³
<i>Albizia adianthifolia</i> (Schumach.) W. Wight (FABACEAE – MIMOSACEAE)	Forest	Declining ³ .	No data.	No data.	
<i>Harpephyllum caffrum</i> Bernh. ex Krauss (ANACARDIACEAE)	Forest	Not threatened.	Produces coppice and will recoppice.	No	

Table 2.1 continued Trade and conservation of ten popular bark species (in order of demand) in KwaZulu-Natal, South Africa

<i>Cassine papillosa</i> (Hochst.) Kuntze (CELASTRACEAE)	Forest	Declining ³ .	Good coppice production ⁸ .	No data.	146 bags* ³
<i>Cassine transvaalensis</i> (Burt Davy) Codd (CELASTRACEAE)	Grassland	Declining ³ .	No data.	R 15/bag* ³	No data.
<i>Rapanea melanophloeos</i> (L.) Mez (MYRSINACEAE)	Forest	Not threatened.	Poor coppicing ability ⁹ .	R 10/bag* ³ in KZN, R 33 – R 83/kg in Mpumalanga Province ¹⁰	327 bags* ³

¹Sensu LOW & REBELO (1996); ²MANDER (1998); ³CUNNINGHAM (1988); ⁴SCOTT-SHAW (1999); ⁵HILTON-TAYLOR (1996); ⁶CREIG (1984); ⁷MANDER *et al.* (1995); ⁸MUIR (1990); ⁹GELDENHUYS (2002a); ¹⁰BOTHA *et al.* (2001).

* Bags refer to standard 50 kg-size maize bags. While no estimates of the mass of bark material contained in one bag are provided, CUNNINGHAM (1988) estimated that one bag might represent the bark of three *Ocotea bullata* trees with diameters of 40-44 cm at breast height.

In the South African context, the success of conservation by cultivation depends on cultivation *en masse*, and market prices that compete with those of gatherers (CUNNINGHAM 1991, CROUCH 2000). In accordance with guidelines laid out by WHO, IUCN & WWF (1993), cultivation allows simultaneous *ex situ* conservation of medicinal plant species and *in situ* conservation of natural populations in their natural habitats. Indeed, effective conservation of plant germplasm may incorporate both approaches.

High-yield horticultural techniques (namely micropropagation of clonal plantlets) essentially generate "conservation products" that promote germplasm preservation (CROUCH 2000). Yet the advantage, that less plant material is initially required than conventionally, must be weighed against the expense of the technique (CROUCH 2000). Micropropagation is used by the Greater Durban Metropolitan Council to mass-produce medicinal herbaceous, bulbous and tree species for various market participants (CROUCH 2000). MANDER *et al.* (1996) reported that Mondi, a South African timber company, mass-produced popular medicinal trees (but failed to name the species). *Warburgia salutaris* and *Catha edulis* (Vahl.) Forssk. ex Endl. are propagated in KwaZulu-Natal by the Medicinal Flora Co-Operative, which endeavours to propagate certain medicinal plants for existing markets (ANONYMOUS 2000). Whilst the propagation of any medicinal species may contribute to the conservation of indigenous flora - providing there is a definite ready market - it is important that efforts are channelled towards high-priority species before taxa under less threat of extinction (CROUCH 2000). Cultivation of *C. edulis*, for example, is unlikely to make as significant a contribution as, for example, *Curtisia dentata* or any other popular and critically threatened species in the KwaZulu-Natal marketplace. According to GELDENHUYS (2000), economically valuable and fast growing species suitable for woodlot cultivation include *Ptaeroxylon obliquum* (Thunb.) Radlk. (Ptaeroxycaceae), *Milletia grandis* (E.Mey.) Skeels (Fabaceae - Papilionaceae), *Rapanea melanophloeos* (Myrsinaceae), *Prunus africana* (Rosaceae) and *Podocarpus falcatus* (Thunb.) R. Br. ex Mirb. (Podocarpaceae).

Despite the merits of *ex situ* conservation, an important consideration is phytochemical variation within plant populations, chemotypes within taxa, and between cultivated and naturally occurring specimens, as well as cultural preferences for the latter. DAHLGREN & VAN WYK (1988), for example, noted that the sweet scent emitted by *Greyia sutherlandii* Hook. ex. Harv. (Greyiaceae) at certain times of the year was not detectable in cultivated specimens. Standardisation of herbal medicines in terms of plant material, properties and usage has been dealt with thoroughly in the literature (GEORGE *et al.* 2001, McCHESNEY 2001, FABRICANT & FARNSWORTH 2001). Molecular analysis of intraspecific genetic diversity in *Prunus africana* populations identified two genotypic groups that showed greater variation between countries than between populations (ICRAF ONLINE 2000).

Species reintroductions and translocations will become increasingly important conservation tools in the future (SMITH *et al.* 2002), representing the *in situ* application of *ex situ* conservation techniques such as seedbanking and micropropagation. Although many species have been successfully reintroduced to their natural habitats, the success of reintroductions rides on case-by-case evidence thus far, and the practice is sometimes contested. For example, large supplies of clonal micropropagated material are available for the reintroduction of *Warburgia salutaris* to its indigenous habitat in KwaZulu-Natal, where it is extinct. However, reintroduction of clonal material would impact negatively on genetic diversity. Similarly, introduction of foreign material (from Kenya, Tanzania and other regions of Africa) to protected areas has been challenged due to genotypic implications for local populations (Pers. comm. BERJAK 2002⁹).

It is unlikely that even commercial forests of indigenous trees would be able to meet the short-term demand for bark products in KwaZulu-Natal, but cultivation would ensure supply in the long-term (MANDER 1998). Slow growing species that are unlikely to be cultivated by commercial enterprises will need to be the focus of government and NGO (Non-Governmental Organisation) activities, and would require extensive rotational areas to ensure availability (CUNNINGHAM 1990b, MANDER 1998). Tree plantations are unattractive to farmers with limited resources, as the maturation period is non-productive, although long-term product yields may be lucrative (e.g. *Prunus africana* bark contains the active principle for which it is used after 12 to 15 years (ICRAF ONLINE 2000)). Propagation of medicinal trees is largely considered a secondary crop to enhance income-generating potential of land used for cash crops and monoculture. Research and educational programmes, aiming to increase cultivation of medicinal plants as cash crops, are concentrated on rapid return-generating herbaceous and shrubby plants, not trees (JÄGER & VAN STADEN 2000). Since medicinal consumption of selected species is unlikely to change, the risks for producers are lowered (MANDER 1998).

It is clear that government, NGOs and parastatals may be the only potential source of bark medicines in the near future, at least until forestry for NTFPs is viewed as a commercially viable farming option. Commercialisation of other NTFPs is rising as developers seek new commercial opportunities, and development agencies seek to improve the welfare of rural communities (SHACKLETON 2001). Although exploitation of NTFPs may intensify the problem of non-sustainable harvesting of tree resources, commercialisation under the auspices of carefully managed projects may indeed secure sustainability. An example of the latter is the "Marula Commercialisation for Sustainable Livelihoods Project", funded by the UK Department for International Development (DfID), which focuses on commercialisation of NTFPs from *Sclerocarya birrea* in southern Africa (SHACKLETON 2001). In Africa, common limitations on the

⁹ Prof Pat Berjak, University of Natal, Durban.

commercialisation of resources within the framework of sustainable development include problems of peace, political stability, infrastructure, expertise and integrated planning (GELDENHUYS & VAN WYK 2002).

In the interim, MANDER (1998) recommended the demand for bark products might be coordinated with timber operations in indigenous forests in order to optimise opportunities in market supply. Bark may be a by-product from the timber industry in the Cape Province, where indigenous forests are exploited for high-value timber (MANDER 1998). Similarly, land clearance for development or agricultural purposes may also provide a source of barks, albeit irregular (CUNNINGHAM 1988). Orchestrated timber and bark harvesting, using efficient techniques, could result in fewer trees being harvested with less damaging effects on resources (GELDENHUYS 2002a). In South Africa, seeded plantations of the exotic *Acacia mearnsii* are felled for their tannin-rich bark, and the bark-stripped wood used for fuel (CUNNINGHAM 2001). Elsewhere, *Cinnamomum zeylanicum* plantations are cultivated for their bark on a coppice rotation, where individual stems are felled and stripped of their bark (CUNNINGHAM 2001). There is therefore great potential for lasting bark supplies as a consequence of management practice aimed at sustaining other products from trees, such as timber and fuelwood.

Another solution to the problem of meeting demands for medicinal plant material without compromising natural populations is the practice of plant part substitution. Non-sustainable products such as bark, bulbs and roots may be replaced with aerial parts such as leaves and twigs, as harvesting of these parts inflict less damage (ZSCHOCKE *et al.* 2000b). It is well known that phytochemical constituents are sometimes alike in different organs of a plant species, and therefore show similar biological activity. For example, phytochemical constituents of the bark and leaves of *Ocotea bullata* are very similar, and exhibit similar biological activity *in vitro* (ZSCHOCKE *et al.* 2000a), as is the case for *Warburgia salutaris* bark and leaves (ZSCHOCKE *et al.* 2000b, DREWES *et al.* 2001). In KwaZulu-Natal, some healers are managing cultivated *O. bullata* and *W. salutaris* saplings for coppice production, thereby inducing high leaf yields that are used instead of bark (Pers. comm. McKEAN 2001¹⁰). The use of *W. salutaris* leaves instead of bark to treat fungal and respiratory complaints was successfully implemented as part of one medicinal plant project in KwaZulu-Natal (HUTCHINGS 2002). However, JÄGER *et al.* (2001) noted that substitution of mature *O. bullata* bark with twigs or immature bark may be problematic. Powdered bark is a popular snuff remedy for headache, but only the mature bark yields a sufficiently fine powder. In many cases certain plant parts are chosen and used for very particular reasons – not always phytochemical – and may not be substitutable.

Whilst sustainable harvesting may be possible, deviation from such management practice to increase yields is a real threat to any system. For example, CUNNINGHAM & MBENKUM (1993) reported over-

¹⁰ Mr Steve McKean, KwaZulu-Natal Wildlife, Pietermaritzburg.

harvesting of *Prunus africana* bark in Cameroon for European export. Bark is sourced exclusively from natural populations, and whilst the species is particularly resilient to bark removal, excessive harvesting pressure has impacted strongly on extant populations.

Interest in the over-exploitation of medicinal plants has grown in the past decade, and questions of conservation, regulation, alternative resources, and the standardisation of traditional medicines are receiving increasing attention. In KwaZulu-Natal alone, numerous commendable projects on sustainable resource management for indigenous plants are underway. Earlier investigations of the medicinal plant trade, notably those of CUNNINGHAM (1988, 1990a, 1991), MANDER (1998) and others (MANDER *et al.* 1995, 1996, 1997), highlighted socio-economic aspects of the trade in relation to biodiversity. Pioneering cultivation trials and education programmes for traditional medical practitioners were started at Silverglen Nature Reserve in Durban; the Durban Parks Department and National Botanical Institute are now involved in cultivation and awareness programmes too (Pers. comm. SYMMONDS 2001¹¹). In 1996, the Institute of Natural Resources (an associate of the University of Natal) began an investigation into the economic feasibility of cultivating high value medicinal plants for local medicinal markets (MANDER 1998). Commercial Products from the Wild, an Innovation Fund Project funded by the Department of Arts, Culture, Science and Technology (DACST), aims to develop ecologically, socially and economically viable and sustainable small business based on medicinal plants (GELDENHUYS 2001). KZN Wildlife (formerly the KwaZulu-Natal Nature Conservation Service) initiated several projects, including a Traditional Healers and Muthi Traders Committee, aimed at sustainable management of traditional medicine plants, controlled harvesting, promotion of awareness among traders, and co-ordination of conservation policies and law enforcement within KwaZulu-Natal (GUMEDE 2000). (Since commercialisation of the medicinal plant trade continues to impose the most significant limitations on the success of indigenous forest conservation, efforts to secure sustainable resources for domestic use, and alternatives for commercial supply, are critical (Pers. comm. VERMEULEN 2002).

The Valley Trust Social Plant Use Programme (SPUP) aims to "influence the way in which people realise their potential and utilise the resources they have to improve their lives and self-reliance" (THE VALLEY TRUST SPUP 2001). The role of the programme in primary healthcare is to improve management options for integrated land use and traditional plant resources. Knowledge is disseminated via the District Health System, and SPUP seeks to encourage bilateral cooperation between Western and traditional medical practitioners, and promote sustainable use of medicinal plants (Pers. comm. HAGUE 2001¹²). In the absence of an integrated provincial or national approach to the conservation of the medicinal flora, however,

¹¹ Mr Richard Symmonds, Durban Botanic Gardens.

¹² Mr Richard Hague, The Valley Trust, KwaZulu-Natal.

the various socially- and financially-motivated efforts to propagate and market medicinal plants may be ineffectual (CROUCH 2000). Despite shortfalls in existing conservation policy and practice, the urgency for medicinal plant conservation requires action before many questions of sustainable management have been answered (Pers. comm. VERMEULEN 2002). Indeed, there is a need to adjust the perception that indigenous resources should be policed, sometimes ineffectively, until adequate research has been undertaken (GELDENHUYS 2002b).

The role of such programmes in establishing contact and cooperation between traditional medical practitioners, plant gatherers, traders and conservationists, provides a crucial outlet for the findings of academic studies. It remains to be seen if indeed these projects are achieving their goals. The urgent need for effective conservation measures and alternative sources of traditional plant medicines depends upon the synthesis of existing and new knowledge, and implementation, of both.

Bark medicines in traditional healthcare in KwaZulu-Natal, South Africa: An inventory

Why are ethnobotanical inventories important?

Accounts of plants used traditionally assist not only in the *ex situ* conservation of indigenous culture, knowledge and belief systems (RAJAN *et al.* 2001), but also in channelling research towards useful plant species (LEWIS 2000). The ethnobotanical approach to plant research highlights that those species used traditionally are most likely to yield useful products and are most likely to be threatened by over-exploitation (Chapter 2). Furthermore, indigenous knowledge is recognised as valuable in reducing environmental degradation and promoting sustainable utilisation (CUNNINGHAM 1988, HEDBERG 1993, DE BEER 2000, OKOJI 2001). Understanding the dynamics of people-plant interactions may facilitate important contributions to the management of flora where it is most relied upon (CUNNINGHAM 2000, WILLIAMS *et al.* 2000). An inventory of locally important plant species can be invaluable in this process of understanding. In the case of medicinal flora, demands, species used and their popularity, can reflect regional differences in the health needs of local users (WILLIAMS *et al.* 2000). The role of the inventory therefore extends beyond a simple list of plants, vernacular names and usage. Although inventories have been criticised for not being sufficiently scientific (CUNNINGHAM 2000, BOTHA *et al.* 2001), the information contained in a local plant checklist may provide the substrate on which subsequent studies are based.

South Africa has a long history of research in economic botany that focussed on plants with agricultural potential, and on weed control (WICKENS 1990). More recently, the economic potential of South African medicinal plants has been recognised. In contrast, ethnobotanical or anthropological studies of people-plant interactions in this country are relatively few. The single and therefore definitive chronicle of the Zulu pharmacopoeia is that of HUTCHINGS *et al.* (1996). Other recent ethnobotanical inventories of South African medicinal plants include those of HUTCHINGS (1989a, 1989b), SCOTT-SHAW (1990), WILLIAMS *et al.* (2000, 2001), and BOTHA *et al.* (2001), as well as economic studies by authors such as CUNNINGHAM (1988), MANDER *et al.* (1997) and MANDER (1998).

Bark in the South African literature

Barks comprise nearly one third of the medicinal plant products traded and used in South African traditional healthcare (MANDER 1998). Despite the importance of bark in South African traditional medicine,

ethnobotanical literature about it is scant or inaccessible. There are several accounts of traditional plant medicines in South Africa (e.g. WATT & BREYER-BRANDWIJK 1962, CUNNINGHAM 1988, HUTCHINGS 1989a, 1989b, ROBERTS 1990, HUTCHINGS *et al.* 1996, VAN WYK *et al.* 1997, VAN WYK & GERICKE 2000, BOTHA *et al.* 2001, WILLIAMS *et al.* 2000, 2001). Several publications on the South African flora have included medicinal usage (PALMER & PITMAN 1961, IMMELMAN *et al.* 1973, COATES PALGRAVE 1977, POOLEY 1993, MANDER *et al.* 1995, SCOTT-SHAW 1999). Ethnobotanical accounts of the South African flora, such as those of GERSTNER in 1938 and 1939 (cited in GEORGE *et al.* 2001), WATT & BREYER-BRANDWIJK in 1962, and BRYANT in 1966 (cited in GEORGE *et al.* 2001), succeeded in documenting early ethnographic information before it disappeared (GEORGE *et al.* 2001). However, none addresses barks in particular.

Literature dealing with other aspects of bark research, such as anatomy and phytochemistry, are prolific, but historically fraught with confusion in terminology (MARTIN & CRIST 1970, BORGER 1973, TROCKENBRODT 1990, JUNIKKA 1994). Furthermore, such studies of medicinal barks have focussed on traditional American and Asian healthcare.

Despite concerns voiced for the South African flora threatened by medicinal exploitation, there is a lack of comprehensive information to empower efforts of conservation, trade monitoring and healthcare standardisation. This needs to be addressed – a problem with resolution in increasing South African ethnobotanical research and publications in recent years.

Compilation of a database of barks used medicinally in KwaZulu-Natal

A comprehensive literature survey was undertaken to consolidate existing knowledge of the usage, properties and conservation status of plant species used medicinally for their bark in KwaZulu-Natal, South Africa. It was intended that a single source of information, dealing specifically with ethnomedical barks, would be generated from the most popular and widely available literature that forms the basis of ethnobotanical studies in South Africa, as well as other sources. The literature was assessed in terms of the usefulness of recorded information, and how it may be translated to the conservation of medicinal bark species.

Plant species used medicinally for their stem- and/or rootbark in KwaZulu-Natal, South Africa were identified in literature surveys. Whilst HUTCHINGS *et al.* (1996) focussed on Zulu traditional medicine, users of other cultures may consult traditional healthcare in the province (increasing numbers of immigrants in South Africa's urban centres make use of traditional healthcare (WILLIAMS 1996)). A Microsoft® Access

2000© database was designed to accommodate searchable data fields detailing bark usage and properties for each taxon. Sensitive parameters were set to ensure that only data referring explicitly to the medicinal purpose or properties of bark used in KwaZulu-Natal (but may occur and be used elsewhere) were included; this selective approach aimed to ensure quality rather than quantity of information in the database. Data collected from diverse media were entered into several categories: Afrikaans, English and Zulu vernacular plant names; usage in the province and southern Africa; field descriptions and biochemical properties of the bark; conservation status and trade; and miscellaneous notes (Table 3.1). Rather than a numeric reference system, sources were cited in the text. Species entries from the database are presented here in alphabetical order rather than taxonomic relationships for ease of reference.

Table 3.1 Structure of species information in a database of barks used medicinally in KwaZulu-Natal, South Africa (explanatory notes are given in parentheses)

Category	Database cell headings
LATIN NOMENCLATURE	Family
	Genus
	Species
	Authority (taxa exotic to South Africa denoted by [E])
	Sub-species taxon (including authority)
	Synonyms (including authorities)
VERNACULAR NOMENCLATURE	English/Afrikaans (denoted by E or A respectively)
	Zulu
BARK CHARACTERS	Description (morphological and field characters)
	Properties (phytochemical properties and biological activity)
MEDICINAL USAGE	Use in KwaZulu-Natal
	Use in southern Africa
CONSERVATION STATUS	Conservation (conservation status, management options, economic data)
MISCELLANEOUS DATA	Notes

Botanical nomenclature was taken mostly from BRUMMIT & POWELL (1992), ARNOLD & DE WET (1993), MABBERLEY (1997) and WIERSEMA & LEON (1999). With reference to the three dominant language groups in the province, common English, Afrikaans and Zulu names were taken from the literature. Zulu nouns are characterised by a prefix and stem that are sometimes denoted by a hyphen and/or capitalised stem. For example, the common Zulu name for *Acacia sieberiana* DC. is 'umkhamba'; for clarity, it may be written as 'umKhamba' or 'um-khamba', and likely indexed as '-Khamba (um)'. In this case, however, Zulu nouns were presented in the more correct form (WILLIAMS *et al.* 2001), without distinction between the prefix and stem.

The medicinal, magico-religious and veterinary purposes for which bark is reportedly used in KwaZulu-Natal and the southern African region were recorded. Other purposes for which bark is used (e.g. fibre, fuel) were omitted. An effort was made to quantify information such as volumes used in preparation and dosage of medicines (for example, one teaspoon measures 5 ml and one tablespoon 15 ml). Terminology that is obsolete in the context of modern biomedical therapeutics persists in many accounts of traditional medicine (ELVIN-LEWIS & LEWIS 1995), including many consulted for this review. Preconceived values and beliefs superimposed upon evaluations of traditional medicine systems¹ may also influence the information accounted (IWU 1993). Accordingly, the TADWG (International Working Group on Taxonomic Databases for Plant Sciences) standard for recording plant uses (COOK 1995) was employed to implement acceptable terminology where possible.

Morphological and phytochemical descriptors of each species' bark were compiled. Although integral to any catalogue of plant species (WHO, IUCN & WWF 1993), illustrations, distributions, habitat and cultivation data that are well documented in existing accounts were excluded. Notes on conservation status and trade were made, to highlight the value of these barks. Trade information was considered pertinent, including data from outside KwaZulu-Natal, since much of the material traded throughout South Africa is harvested or supplied by markets in KwaZulu-Natal. Data outside other data fields were included as additional notes.

Inventory of traditional bark medicines used in KwaZulu-Natal

A full printout of the database is presented below. Unless otherwise stated, data refer only to species used medicinally for their bark in KwaZulu-Natal, and only the properties of the bark. Data absent from a data field were lacking in the literature consulted. Literature cited is referenced following the printout.

¹ Although *ex situ* conservation of indigenous knowledge is widely accepted, modern interest therein is not without some irony. Through modern studies, indigenous knowledge is isolated, documented, stored and archived, and validated using scientific criteria (AGRAWAL 1995). This institutes Western knowledge as the ultimate system within which other knowledge is substantiated, thereby nullifying definitions of scientific or Western and indigenous knowledge.

Acacia burkei

FAMILY Fabaceae - Mimosaceae

AUTHORITY Benth.

SSP TAXON

SYNONYMS *A. ferox* Benth.

ENGLISH/AFRIKAANS black monkey-thorn (E), swartapiesdoring (A)

ZULU likhaya, umkhaya, umkhaya wehlalahlati, umkhaya wehlatini

DESCRIPTION It is variable in appearance, from smooth, scaly and yellow-grey, to rough and brown-black with knobby thorns on the main trunk (COATES PALGRAVE 1977). Bark on immature branches is yellow-grey to red-brown and velvet-textured, becoming pale or dark yellow-grey to dark brown with maturity (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL It is used to treat eye complaints (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Acacia caffra

FAMILY Fabaceae - Mimosaceae

AUTHORITY (Thunb.) Willd.

SSP TAXON

SYNONYMS *A. caffra* Willd. var. *longa* Glover, *A. caffra* Willd. var. *namaquensis* Eckl. & Zeyh., *A. caffra* Willd. var. *tomentosa* Glover, *A. caffra* Willd. var. *transvaalensis* Glover, *A. fallax* E. Mey., *A. multijuga* Meisn.

ENGLISH/AFRIKAANS common hook-thorn (E), gewone haakdoring (A)

ZULU umthole, umtholo (root)

DESCRIPTION It is dark brown to black, rough, and may be cracked in squares or sometimes peeling in long strips (COATES PALGRAVE 1977, VENTER & VENTER 1996). Bark on immature branches is red-brown and smooth, becoming dark and rough with maturity (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains tannin (WATT & BREYER-BRANDWIJK 1962). Poisoning in livestock, caused by prussic acid in twigs, has been associated with *A. caffra* (KELLERMAN *et al.* 1988 cited in HUTCHINGS *et al.* 1996). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Infusions are taken as blood-cleansing emetics (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION *A. caffra* was among the thirteen most frequently demanded medicinal species in KwaZulu-Natal (MANDER 1998).

ADDITIONAL INFORMATION

Acacia gerrardii

FAMILY Fabaceae - Mimosaceae

AUTHORITY Benth.

SSP TAXON var. *gerrardii*

SYNONYMS *A. gerrardii* Benth., *A. hebecladoides* Harms

ENGLISH/AFRIKAANS grey-haired acacia (E), red thorn (E), rooibas (A), rooidoring (A)

ZULU umngampunzi, umphuze, umsama, unkhamanzi

DESCRIPTION It is dark grey or red-toned, and may be rough or smooth; immature branches are covered by grey, velvet-textured pubescence (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Acetone extracts have yielded 5(+)-catechin galloyl esters (MALAN & PIENAAR 1987 cited in HUTCHINGS *et al.* 1996). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Decoctions are used for emetics and enemas (WATT & BREYER-BRANDWIJK 1962). To overcome or neutralise a dislike of fellow men, decoctions are heated and the vapour inhaled (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION SHACKLETON (2000) found that coppice production is not sensitive to the cutting height at which trees are felled, but coppice shoots will increase with increased stump surface area.

ADDITIONAL INFORMATION

Acacia karroo

FAMILY Fabaceae – Mimosaceae

AUTHORITY Hayne

SSP TAXON

SYNONYMS *A. capensis* (Burm.f.) Burch., *A. hirtella* E. Mey., *A. hirtella* Willd. var. *inermis* Walp., *A. horrida* Willd., *A. horrida* Willd. var. *transvaalensis* (Burt Davy), *A. inconfagrabilis* Gerstn., *A. karroo* Hayne var. *transvaalensis* (Burt Davy) Burt Davy, *A. reticulata* (L.) Willd., *Mimosa capensis* Burm.f., *M. leucacantha* Jacq., *M. nilotica* Thunb.

ENGLISH/AFRIKAANS sweet thorn (E), white thorn (E), soetdoring (A)

ZULU isikhombe, umnga, umunga

DESCRIPTION It is dark red-brown, almost black, slightly rough and flaking, revealing reddish inner bark or wood; immature branches are rust-coloured due to the underbark being exposed by the peeling outer bark (COATES PALGRAVE 1977, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Bark is rich in tannins (VAN WYK *et al.* 1997). Gum frequently accumulates around wounds on the bark; an arabinose-galactose gallo-tannin, known as Cape gum (similar to gum arabic), is used in the pharmaceutical industry for emollient, emulsifier, stabiliser and additive purposes (VAN WYK *et al.* 1997). Uronic acid (10.3 - 18.1 %) and rhamnose (4 - 10 %) have been isolated in the gum (ANDERSON & PINTO 1980 cited in HUTCHINGS *et al.* 1996). The heartwood also contains acacatechin, catechutannic acid and quercetin, which have anti-diarrhoeal properties (MARTINDALE 1972 cited in VAN WYK *et al.* 1997). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Decoctions are used against ailments induced by sorcery (WATT & BREYER-BRANDWIJK 1962). Bark is also used in an astringent medicine (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA Outside KwaZulu-Natal, the bark is used with the leaves in a tea for coughs, colds, diarrhoea, stomach aches, haemorrhage and ophthalmia or conjunctivitis; it is similarly used in ethnoveterinary medicine for diarrhoea, coughs and ophthalmia in cattle and dogs (WATT & BREYER-BRANDWIJK 1962, ROBERTS 1990). Infusions are used in ethnoveterinary medicine as an antidote to poisoning as a result of eating *Moraea* sp. (COATES PALGRAVE 1977). In the Cape Province, it is used against diarrhoea and dysentery (HUTCHINGS *et al.* 1996). Gum is used with *Capsicum* sp. fruit and strong vinegar in a dressing for acute osteomyelitis, and to draw abscesses and splinters (HUTCHINGS *et al.* 1996). It is diluted with water and used as a mouthwash against oral thrush [*Candida albicans*] and sprue (VENTER & VENTER 1996). Thorns are used to relieve heart pains and magical purposes (MABOGO 1990 cited in HUTCHINGS *et al.* 1996).

CONSERVATION

ADDITIONAL INFORMATION

Acacia luederitzii

FAMILY Fabaceae - Mimosaceae

AUTHORITY Engl.

SSP TAXON var. *luederitzii*

SYNONYMS *A. goeringii* Schinz, *A. luederitzii* Engl.

ENGLISH/AFRIKAANS bastard umbrella thorn (E), belly thorn (E), fat-thorned acacia (E), Kalahari sand

acacia (E), basterhaak-en-steek (A), buikdoring (A)

ZULU ugagu, umbambampala, umshangwe

DESCRIPTION It is very rough, longitudinally fissured and ridged; immature branches show dense grey or white woolly pubescence; older branches are purple-toned to dark brown-black (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL It is used for unspecified purposes (POOLEY 1993).

USE IN SOUTHERN AFRICA It is used by the Tonga for emetic decoctions (WATT & BREYER-BRANDWIJK 1962).

CONSERVATION

ADDITIONAL INFORMATION

Acacia nilotica

FAMILY Fabaceae - Mimosaceae

AUTHORITY (L.) Willd. ex Delile

SSP TAXON ssp. *kraussiana* (Benth.) Brenan

SYNONYMS *A. nilotica* (L.) Willd. ex Del.

ENGLISH/AFRIKAANS black thorn tree (E), redheart tree (E), scented-pod acacia (E), scented thorn (E), lekkerruikpeul (A), snuifpeul (A), soetlekkerruikpeul (A), stinkpeul (A)

ZULU ubobe, ubombo, umngawe, umqawe

DESCRIPTION Bark is red-brown and smooth, becoming black-grey and roughly fissured with maturity; immature branches show grey to brown bark (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is strongly astringent, and bark sap is reported to have coagulating properties (WATT & BREYER-BRANDWIJK 1962). Decoctions have intoxicating and detergent effects (HUTCHINGS *et al.* 1996). Octasonal-1-ol, B-amyrin and betulin have been elucidated from the rootbark (PRAKASH & GARG 1981 cited in HUTCHINGS *et al.* 1996). Several phytochemical constituents have been isolated, including gallo-catechin, protocatechuic acid, catechol and pyrocatechol (HUTCHINGS *et al.* 1996). Ethanol extracts have shown antigonococcal and anti-amoebic activity *in vitro*, hypotensive activity in dogs, contraction-inhibiting effects in guinea-pig ileum, and coagulation of rat and human semen (HUTCHINGS *et al.* 1996). Stembark extracts have also shown molluscicidal and algicidal properties (AYOUB 1983, 1984 cited in HUTCHINGS *et al.* 1996). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Decoctions are used to soothe dry coughs and loosen phlegm (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA Decoctions are applied topically to ulcerations caused by leprosy, or taken orally for coughs (VENTER & VENTER 1996). Gum exuded from the stems is taken against throat and chest complaints (VENTER & VENTER 1996).

CONSERVATION

ADDITIONAL INFORMATION

Acacia robusta

FAMILY Fabaceae - Mimosaceae

AUTHORITY Burch.

SSP TAXON

SYNONYMS *A. robusta* Burch. ssp. *robusta*

ENGLISH/AFRIKAANS ankle thorn (E), splendid acacia (E), enkeldoring (A)

ZULU umngamanzi, umngawe

DESCRIPTION Bark is grey to dark brown, sometimes smooth, but frequently deeply fissured (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Bark is ground and mixed with water to evict snakes (PALMER & PITMAN

1961). It is also used for magical purposes (POOLEY 1993). It is crushed and boiled, and the steam inhaled to treat chest complaints, or the preparation applied to skin ailments (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION *A. robusta* Burch. ssp. *clavigera* (E. Mey.) Brenan is not separated from *A. robusta* Burch. ssp. *robusta* in Zulu medicine (HUTCHINGS *et al.* 1996).

Acacia sieberiana

FAMILY Fabaceae - Mimosaceae

AUTHORITY DC.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS Natal camel thorn (E), paper bark acacia (E), pepperbark acacia (E), papierbasdoring (A)

ZULU likhaya, umkhamba, umkhambati, umkhaya

DESCRIPTION Bark is light brown to yellow-grey, sometimes corky, and flaking in paper-like strips (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Aqueous and ethanolic extracts showed *in vitro* antibacterial activity against *Staphylococcus epidermis* and *Bacillus subtilis* (RABE & VAN STADEN 1997). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Infusions are administered as enemas for back pain (WATT & BREYER-BRANDWIJK 1962), and used by women to relieve chafing in the genital region (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Acacia tortillis

FAMILY Fabaceae - Mimosaceae

AUTHORITY (Forssk.) Hayne

SSP TAXON ssp. *heteracantha* (Burch.) Brenan

SYNONYMS

ENGLISH/AFRIKAANS umbrella thorn (E), haak-en-steek (A)

ZULU isihoba, isithwethwe, umsasane

DESCRIPTION Bark is grey to red-brown with short hairs on immature branches, becoming grey or dark brown and fissured (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL It is used for unspecified purposes (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Acacia xanthophloea

FAMILY Fabaceae - Mimosaceae

AUTHORITY Benth.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS fever tree (E), koorsboom (A)

ZULU khanyagude, ukhanygude, umdlovune, umhlofunga, umhlosinga, umkhanyagude, umkhanyakude

DESCRIPTION The characteristic bark, to which the common names are attributable, is smooth, green-

yellow to yellow, flaking and powdery (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL It is powdered and used as a prophylactic or treatment for malaria (WATT & BREYER-BRANDWIJK 1962). It is a common good luck charm (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION *A. xanthophloea* was identified by both urban and rural herbalists as one of 15 species that are becoming increasingly scarce in KwaZulu-Natal (CUNNINGHAM 1988). MANDER (1998) ranked it eleventh among medicinal species most frequently demanded by consumers in KwaZulu-Natal. The bark is commonly available at medicinal plant markets on the Witwatersrand (WILLIAMS *et al.* 2000). CUNNINGHAM (1988) reported that a 50 kg-sized bag of bark cost R 10 when purchased from gatherers at Isipingo medicinal plant market, KwaZulu-Natal.

ADDITIONAL INFORMATION

Afzelia quanzensis

FAMILY Fabaceae - Caesalpinaceae

AUTHORITY Welw.

SSP TAXON

SYNONYMS *Afzelia quanzensis* (Welw.) Pierre, *Afzelia attenuata* Klotzsch, *A. petersiana* Klotzsch, *Intsia quanzensis* (Welw.) Kuntze, *Pahudia quanzensis* (Welw.) Prain

ENGLISH/AFRIKAANS chamfuti (E), lucky bean (E), pod mahogany (E), peulmahonie (A)

ZULU inkehli (seeds), isinkehle, umdlavusa, umhlakuva, umshamfuthi, unhlavusi

DESCRIPTION Bark is cream-brown to grey-brown and with pale regions as a result of flaking, typically in round, woody scales (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Powdered bark is rubbed on eczema after python fat has been applied (PALMER & PITMAN 1961).

USE IN SOUTHERN AFRICA Bark is infused overnight with the roots, and bathed in by huntsmen as a good luck charm (COATES PALGRAVE 1977). Powdered bark is believed to repel attack or provocation by others (COATES PALGRAVE 1977). Toothache is relieved by local application of the bark (VENTER & VENTER 1996).

CONSERVATION

ADDITIONAL INFORMATION

Alberta magna

FAMILY Rubiaceae

AUTHORITY E. Mey.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS Natal flame bush (E), breekhout (A)

ZULU ibutha-elikhulu, ibuthe, igampondo, igibiampondo,

DESCRIPTION Bark is pale grey, smooth but becoming rough and almost folded with age (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL The bark is used for unspecified purposes (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION It is globally rare (HILTON-TAYLOR 1996), protected and conservation-dependent in KwaZulu-Natal (SCOTT-SHAW 1999).

ADDITIONAL INFORMATION

Albizia adianthifolia

FAMILY Fabaceae - Mimosaceae

AUTHORITY (Schumach.) W. Wight

SSP TAXON

SYNONYMS *A. fastigiata* (E. Mey.) Oliv., *Inga fastigiata* (E. Mey.) Oliv., *Mimosa adianthifolia* Schumach., *Zygia fastigiata* E. Mey.

ENGLISH/AFRIKAANS flat crown (E), rough-bark flat crown (E), platkroon (A)

ZULU budhlo, igowane, indlandlovu, ubudhlo, umbhelebhele, umgadankawu, umgadenkawu, umhlandothi, umnalahlanga, umnebelele, usolo

DESCRIPTION The bark is smooth or rough, grey to yellowish-brown, and flaking (COATES PALGRAVE 1977, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The bark is toxic (COATES PALGRAVE 1977). A terpenoid compound was isolated from the rootbark (ROQUES *et al.* 1977 cited in HUTCHINGS *et al.* 1996) and high concentrations of histamine (MAZZANTI *et al.* 1983 cited in HUTCHINGS *et al.* 1996). It has shown anti-inflammatory activity (JÄGER *et al.* 1996). The barks of various *Albizia* spp. have yielded saponins, sapogenins, histamine and other imidazole derivatives, suggestive of analgesic, decongestant and topical hyposensitivity effects (VAN WYK *et al.* 1997).

USE IN KWAZULU-NATAL Pounded bark is used in aqueous lotions for the relief of itchy skin complaints such as eczema (BRYANT 1966 cited in HUTCHINGS *et al.* 1996). Powdered bark is taken as a snuff for headaches (HUTCHINGS *et al.* 1996). It is used as love charms, and enemas to clear the urine in pregnant women (WATT & BREYER-BRANDWIJK 1962, PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It has been used to treat bronchitis in southern Africa (HUTCHINGS *et al.* 1996). A cold infusion is used locally to reduce inflammation of the eye (WATT & BREYER-BRANDWIJK 1962). Powdered bark is used as a snuff for headaches and sinusitis (PUJOL 1990 cited in VAN WYK & GERICKE 2000). Stomach ailments are treated with a weak infusion of powdered bark (approximately 5 ml material in 500 ml water) (VAN WYK *et al.* 1997). Eczema is treated with a highly reputed bark infusion (VAN WYK & GERICKE 2000).

CONSERVATION *A. adianthifolia* was one of 15 species identified by urban herbalists as becoming increasingly scarce in KwaZulu-Natal (CUNNINGHAM 1988). It was ranked among the most frequently demanded medicinal plants in KwaZulu-Natal (MANDER 1998). The bark is commonly traded in medicinal plant markets on the Witwatersrand (WILLIAMS *et al.* 2000).

ADDITIONAL INFORMATION It is considered one of the most important African medicinal plants (IWU 1993).

Albizia anthlemintica

FAMILY Fabaceae - Mimosaceae

AUTHORITY (A. Rich.) Brongn.

SSP TAXON

SYNONYMS *Acacia inermis* Marloth, *Acacia marlothii* Engl., *Albizia anthelmintica* (A. Rich.) Brongn. var. *australis* Bak. f., *A. anthelmintica* (A. Rich.) Brongn. var. *pubscens* Burt Davy, *A. umbalusiana* Sim, *Besenna anthelmintica* A. Rich.

ENGLISH/AFRIKAANS worm-cure albizia (E), wurmbasvalsoring (A)

ZULU bulani, lubulani, umnalahlanga

DESCRIPTION The bark is pale grey, red-grey to brown, and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It showed no toxic effects in clinical trials for anthelmintic properties (WATT & BREYER-BRANDWIJK 1962). Powdered bark has proved to be more efficient than decoctions for anthelmintic properties (HUTCHINGS *et al.* 1996). Rootbark contains a triterpenoid saponin, deglucomusennin and echinocystic acid, and musennin, to which anthelmintic activity is attributed (TSCHESCHE & KÄMMERER 1969 cited in HUTCHINGS *et al.* 1996). Saponin fractions do not exhibit anthelmintic activity (WATT & BREYER-BRANDWIJK 1962). High concentrations of histamine are present

(MAZZANTI *et al.* 1983 cited in HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL It is used as an anthelmintic (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used as an anthelmintic in Namibia, particularly against tapeworm; it is best administered as a powder (COATES PALGRAVE 1977).

CONSERVATION Traders in Mpumalanga consider the bark to be rare; bark products cost R 100/kg (BOTH A *et al.* 2001).

ADDITIONAL INFORMATION It is considered one of the most important African medicinal plants (IWU 1993).

Albizia petersiana

FAMILY Fabaceae - Mimosaceae

AUTHORITY (Bolle) Oliv.

SSP TAXON ssp. *evansii* (Burt Davy) Brenan

SYNONYMS *A. evansii* Burt Davy

ENGLISH/AFRIKAANS many-stemmed albizia (E), veelstamvalsoring (A)

ZULU umnala, umnalo, umnaloqho

DESCRIPTION Bark is grey and pubescent on immature branches (COATES PALGRAVE 1977).

PHYTOCHEMICAL/ PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Albizia suluensis

FAMILY Fabaceae - Mimosaceae

AUTHORITY GERSTNER

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS Zulu albizia (E), Zulu false thorn (E), Zoeloevalsoring (A)

ZULU ingweb'enkulu, ingwebo omkhulu, inyazangoma, ungwebo-omkulu, ungwebunkulu, unyazangoma

DESCRIPTION The bark is grey and fissured (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES An irritant foam results if bark is mixed with water (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL It is used for unspecified purposes in KwaZulu-Natal (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION *A. suluensis* is globally rare and vulnerable, and protected in KwaZulu-Natal (CUNNINGHAM 1988, HILTON-TAYLOR 1996, SCOTT-SHAW 1999). MANDER (1998) ranked *A. suluensis* thirteenth out of 70 medicinal species most frequently demanded by consumers in KwaZulu-Natal. Seedling recruitment is negatively impacted by high browsing pressure in Hluhluwe-Umfolozi Park (KHUMALO 2001).

ADDITIONAL INFORMATION

Antidesma venosum

FAMILY Euphorbiaceae

AUTHORITY E. Mey. ex Tul.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS tassel berry (E), tosselbessie (A), voëlsitboom (A)

ZULU isangowane, isibangamlotha, isibangamlotha-sasenkangala, isiqutwane, umhlabahlungu, umhlahlanyoni, umnangazi, umshongi

DESCRIPTION The bark is varying shades of grey or grey-brown, smooth to rough and flaking in long fibres; immature branches are covered with red-brown pubescence (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Rootbark is used to treat dysentery (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION It is notorious for the substantial white-coloured ash produced when it is burned, to which the Zulu vernacular isibangamlotha is attributed (CUNNINGHAM 2001).

Balanites maughamii

FAMILY Balanitaceae

AUTHORITY Sprague

SSP TAXON

SYNONYMS *B. dawei* Sprague

ENGLISH/AFRIKAANS Torch fruit tree (E), torchwood (E), fakkelhout (A), groendoring (A)

ZULU gobandlovu, ugobandlovu, ipamu, iphamba, iphambo, iphamu, liphambo, ugobandlovu, ugobendlovu, umgobandlovu, umnulu

DESCRIPTION The bark is grey and smooth; the trunk is conspicuously fluted in large specimens (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It has mild molluscicidal properties (PRETORIUS *et al.* 1988 cited in HUTCHINGS *et al.* 1996). Members of the genus *Balanites* contain steroidal glycosides derived from diosgenin and structurally related sapogenins, such as cryptogenin (VAN WYK *et al.* 1997).

USE IN KWAZULU-NATAL It is an ingredient in infusions used in rituals to protect against evil spirits: without using the hands, froth is licked from the infusion two to three times daily, then thrown over the roof to spill over the entrance to the house (PALMER & PITMAN 1961). The bark is also used in an exhilarating bath (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In South Africa, bark is applied as cutaneous implantations to strengthen the body, or stem- and rootbark mixed with other ingredients for emetics (VAN WYK *et al.* 1997). In Mozambique, a paste of the bark is cooked and taken orally as a general tonic, or cooked with beans to treat haematuria (VAN WYK & GERICKE 2000). Decoctions are used as emetics; infusions are used to make a refreshing bath (VAN WYK & GERICKE 2000).

CONSERVATION It was classed as declining in KwaZulu-Natal (CUNNINGHAM 1988), and ranked thirteenth out of 70 medicinal species most frequently demanded by consumers in KwaZulu-Natal (MANDER 1998). *B. maughamii* is heavily exploited for bark products in KwaZulu-Natal (Pers. comm. McKEAN 2001¹). In Mpumalanga Province, the bark is considered readily available and is traded at between R 30/kg and R 77/kg (BOTHA *et al.* 2001).

ADDITIONAL INFORMATION

Berchemia discolor

FAMILY Rhamnaceae

AUTHORITY (Klotzsch) Hemsl.

SSP TAXON

SYNONYMS *Phyllogeiton discolor* (Klotzsch) Herzog

ENGLISH/AFRIKAANS bird plum (E), brown ivory (E), mountain date (E), wild almond (E), bruinivoor (A), voëlpruim (A), wildedadel (A)

ZULU ubalatsheni omkhulu, umadlozane, umhloungulo, umumu, uvuku

¹ Mr Steve McKean, KwaZulu-Natal Wildlife, Pietermaritzburg.

DESCRIPTION Bark is dark grey, rough and cracking in rectangular pieces (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used as an alluring love charm (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used in Venda to treat infertility (MABOGO 1990 cited in HUTCHINGS *et al.* 1996). It is a popular traditional medicine plant in South Africa and neighbouring countries (VAN WYK & GERICKE 2000).

CONSERVATION

ADDITIONAL INFORMATION

Berchemia zeyheri

FAMILY Rhamnaceae

AUTHORITY (Sond.) Grubov

SSP TAXON

SYNONYMS *Phyllogeiton zeyheri* (Sond.) Süsseng., *Rhamnus zeyheri* Sond.

ENGLISH/AFRIKAANS ivory wood (E), red ebony (E), red ivory (E), rooi-ivoor (A)

ZULU umgologolo, umncaka, umneyi, umnini

DESCRIPTION The bark is grey and smooth, with pale grey lenticels, becoming darker grey or grey-brown and roughly segmented, particularly near the base, in larger specimens (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Infusions to treat backache and rectal ulceration in children are administered orally or by enema (WATT & BREYER-BRANDWIJK 1962). The barks of *B. zeyheri* and *Ozoroa paniculosa* var. *paniculosa* are infused as a medicine for dysentery in adults (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used by the Vhavenda to treat backache and rectal ulcers (MABOGO 1990 cited in HUTCHINGS *et al.* 1996).

CONSERVATION

ADDITIONAL INFORMATION

Bersama lucens

FAMILY Melianthaceae

AUTHORITY (Hochst.) Szyszyl.

SSP TAXON

SYNONYMS *Natalia lucens* Hochst.

ENGLISH/AFRIKAANS glossy bersama (E), glossy white ash (E), blinkbaarwitessenhout (A)

ZULU isindiyandiya, undiyaza

DESCRIPTION Bark is brown and rough (COATES PALGRAVE 1977). Harvested bark is readily diagnosed by the presence of calcium oxalate crystals, visible in the broken cross-section of dried material (CUNNINGHAM 2001).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Due to the presence of cardiac glycosides (VAN WYK *et al.* 1997), *Bersama* spp. are extremely toxic and may cause fatality. Bark contains high concentrations of calcium oxalate crystals (CUNNINGHAM 2001).

USE IN KWAZULU-NATAL It is used to treat female infertility, menstrual pain and impotence (BRYANT 1966 cited in HUTCHINGS *et al.* 1996, WATT & BREYER-BRANDWIJK 1962). *B. lucens* may be the plant known as 'isandiyandiya', the bark of which is used for leprosy, as a protective charm against evil and lightning, and to confuse an opponent in court (DOKE & VILAKAZI 1972 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In other parts of South Africa, finely powdered bark is snuffed to treat headaches and strokes (PUJOL 1990 cited in VAN WYK *et al.* 1997, HUTCHINGS *et al.* 1996). A tincture is used as a calmative against nervous disorders (HUTCHINGS *et al.* 1996).

CONSERVATION CUNNINGHAM (1988) reported that gatherers sold a 50 kg-sized bag of unidentified *Bersama* bark for R 20 at Isipingo medicinal plant market, KwaZulu-Natal. MUIR (1990) noted that it

coppices well.

ADDITIONAL INFORMATION

Bersama stayneri

FAMILY Melianthaceae

AUTHORITY Phill.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS hairy-leaved bersama (E), water white ash (E), waterwitessenhout (A)

ZULU indiyaza, isindiyandiya

DESCRIPTION The bark is notably thick, dark and rough (COATES PALGRAVE 1977). Harvested bark is readily diagnosed by the presence of calcium oxalate crystals, visible in the broken cross-section of dried material (CUNNINGHAM 2001).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is bitter (COATES PALGRAVE 1977) and contains high concentrations of calcium oxalate crystals (CUNNINGHAM 2001).

USE IN KWAZULU-NATAL WATT & BREYER-BRANDWIJK (1962) noted its use in KwaZulu-Natal. It is likely to be used in similar ways to *B. lucens*, to treat reproductive complaints, leprosy, and as a protective charm (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION COATES PALGRAVE (1977) noted that trees were frequently deformed or destroyed as a result of bark stripping. CUNNINGHAM (1988) reported that gatherers sold a 50 kg-sized bag of unidentified *Bersama* bark for R 20 at Isipingo medicinal plant market, KwaZulu-Natal.

ADDITIONAL INFORMATION

Bersama swinnyi

FAMILY Melianthaceae

AUTHORITY Phill.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS coast bersama (E), coastal white ash (E), Swinny's bersama (E), kuswitessenhout (A)

ZULU isindiyandiya, umhlakaza, undiyaza

DESCRIPTION The bark is brown and rough (COATES PALGRAVE 1977). Harvested bark is readily diagnosed by the presence of calcium oxalate crystals, visible in the broken cross-section of dried material (CUNNINGHAM 2001).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It causes a characteristically strong burning sensation when tasted (COATES PALGRAVE 1977). It contains high concentrations of calcium oxalate crystals (CUNNINGHAM 2001).

USE IN KWAZULU-NATAL It may be used in the same way as that of *B. lucens*, to treat reproductive complaints, leprosy and as a protective charm (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used in the Transkei region for unspecified purposes (PALMER & PITMAN 1961).

CONSERVATION CUNNINGHAM (1988) classed it as declining in KwaZulu-Natal, and reported that gatherers sold a 50 kg-sized bag of unidentified *Bersama* bark for R 20 at Isipingo medicinal plant market, KwaZulu-Natal.

ADDITIONAL INFORMATION

Bersama tysoniana

FAMILY Melianthaceae

AUTHORITY Oliv.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS common bersama (E), common white ash (E), gewone witessenhout (A)

ZULU isindiyandiya, undiyaza

DESCRIPTION Bark is thick, grey to grey-brown, rough and corrugated (COATES PALGRAVE 1977). Harvested bark is readily diagnosed by the presence of calcium oxalate crystals, visible in the broken cross-section of dried material.

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is bitter tasting, and causes characteristic burning and numbness in the mouth (POOLEY 1993). It contains high concentrations of calcium oxalate crystals (CUNNINGHAM 2001).

USE IN KWAZULU-NATAL It may be used in the same way as the bark of *B. lucens*: to treat reproductive complaints, leprosy and as a protective charm (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA The Xhosa use it to reduce fever and hysteria; decoctions are used to treat gallsickness in cattle (WATT & BREYER-BRANDWIJK 1962).

CONSERVATION CUNNINGHAM (1988) classified it as vulnerable and declining in KwaZulu-Natal. It is heavily exploited for bark products in the province (Pers. comm. McKEAN 2001). CUNNINGHAM (1988) reported that gatherers sold a 50 kg-sized bag of unidentified *Bersama* bark for R 20 at Isipingo medicinal plant market, KwaZulu-Natal. It is not readily available in Mpumalanga Province, where bark products cost between R 11 and R 400/kg (BOTHA *et al.* 2001).

ADDITIONAL INFORMATION

Boscia albitrunca

FAMILY Capparaceae

AUTHORITY (Burch.) Gilg & Ben.

SSP TAXON var. *albitrunca*; var. *macrophylla* Tölken

SYNONYMS

ENGLISH/AFRIKAANS emigrant's tree (E), shepard's tree (E), grootwitgatboom (A), jentelmanstam (A), kaboom (A), koffieboom (A), noenieboom (A), witbas (A), wonderboom (A)

ZULU inyokiziphinda, umvithi

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES Other plant parts have been phytochemically analysed (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL It is used for unspecified purposes (Pers. comm. NDLOVU 2001²).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Breonadia salicina

FAMILY Rubiaceae

AUTHORITY (Vahl) Hepper & Wood

SSP TAXON

SYNONYMS *Adina galpinii* Oliv., *A. microphala* (Del.) Hiern, *Breonadia microphala* (Del.) Ridsdale

ENGLISH/AFRIKAANS African teak (E), matumi (E), Transvaal teak (E), water matumi (E), wild oleander (E), mingerhout (A)

² Mr Elliot Ndlovu, Traditional Medical Practitioner, Pietermaritzburg.

ZULU hlume, umfula, umhlume

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES It has astringent properties (DOKE & VILAKAZI 1972 cited in HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL It is used to treat stomach complaints (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION In Mpumalanga Province, the bark is considered readily available and in low demand (BOTH A *et al.* 2001).

ADDITIONAL INFORMATION

Bridelia micrantha

FAMILY Euphorbiaceae

AUTHORITY (Hochst.) Baill.

SSP TAXON

SYNONYMS *Candelabria micrantha* Hochst.

ENGLISH/AFRIKAANS coastal goldenleaf (E), mitzeerie (E), mzerie (E), bruinstinkhout (A), mitserie (A)

ZULU incinci, isihlalamangewibi, isihlalamangwibi, umhlahle, umhlalamagwababa, umhlalimakwaba, umshonge

DESCRIPTION Bark is brown to grey, slightly flaking and rough in mature specimens (COATES PALGRAVE 1977). Immature branches are grey-brown and smooth (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Constituents isolated from the bark include epifreidelinol, taraxerol, gallic acid and ellagic acid (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL Infusions are taken as emetics (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In southern Africa, stem bark is used as a cough expectorant, as a laxative, and in therapy of diabetes (IWU 1993). Powdered bark is applied topically to burns, and reputedly enhances the rate of healing (VENTER & VENTER 1996). The Vhavenda also use it to treat toothache and venereal diseases (MABOGO 1990 cited in HUTCHINGS *et al.* 1996).

CONSERVATION

ADDITIONAL INFORMATION

Burchellia bubalina

FAMILY Rubiaceae

AUTHORITY (L.f.) Sims

SSP TAXON

SYNONYMS *B. capensis* R. Br., *Lonicera bubaline* L.f.

ENGLISH/AFRIKAANS wild pomegranate (E), buffelshoring (A), wildeganaat (A)

ZULU igongqo, isigolwane, umaphekamoyeni, umavutha emfuleni, umvuthemifuleni, uqongqo, utshwala-benyoni omkhulu

DESCRIPTION Bark is smooth, mottled grey (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In southern Africa it is used in ethnoveterinary medicine to bind fractured limbs in animals (BATTEN & BOKELMANN 1966 cited in HUTCHINGS *et al.* 1996).

CONSERVATION

ADDITIONAL INFORMATION

Calodendrum capense

FAMILY Rutaceae

AUTHORITY (L.f.) Thunb.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS Cape chestnut (E), wildekastaing (A)

ZULU memezi, memezomhlope, umbhaba, umemeze omhlope, umemezilomhlope, umemezi omhlope, umemezomhlope

DESCRIPTION Bark is light to dark grey and smooth (VENTER & VENTER 1996, NICHOLLS 2001).

PHYTOCHEMICAL/PHYSICAL PROPERTIES A liminoid and a sesquiterpenoid have been elucidated in unspecified plant parts (GLASBY 1991).

USE IN KWAZULU-NATAL It is used for unspecified purposes (NICHOLLS 2001).

USE IN SOUTHERN AFRICA It is used extensively in the skin-lightener trade in the Eastern Cape Province of South Africa (LA COCK & BRIERS 1992), and bark is sold at markets in Mpumalanga (NICHOLLS 2001).

CONSERVATION In Mpumalanga Province, the bark is readily available and consumer demand high; trade prices range from R 33 to R 435/kg (BOTH A *et al.* 2001).

ADDITIONAL INFORMATION

Casearia gladiiformis

FAMILY Flacourtiaceae

AUTHORITY Mast.

SSP TAXON

SYNONYMS *Casearia junodi* Schinz

ENGLISH/AFRIKAANS sword-leaf (E), swaardblaar (A)

ZULU imfe-yesele, umgunguluzane, umjuluka

DESCRIPTION Bark is smooth and grey in colour (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Bark is burned and the ashes snuffed (PALMER & PITMAN 1961).

USE IN SOUTHERN AFRICA

CONSERVATION It is traded in markets in KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Cassine aethiopica

FAMILY Celastraceae

AUTHORITY Thunb.

SSP TAXON

SYNONYMS *C. albanensis* Sond., *C. tetragona* (L.f.) Loes

ENGLISH/AFRIKAANS Cape cherry (E), kooboo-berry (E), spoonwood (E), kaboehout (A), koeboebessie (A), lepelboom (A)

ZULU inqayi, umgunguluzampunzi, umnqayi, umnqayi obomvu

DESCRIPTION Bark is grey and smooth in immature specimens, becoming dark grey or brown and rough in mature specimens; immature branches are green and softly pubescent (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Infusions of rootbark are made with a handful of bark in approximately 250 ml cold water, and taken for dysentery and diarrhoea. Thereafter the infusion is diluted with 250 ml hot water, and administered by enema (BRYANT 1966 cited in HUTCHINGS *et al.* 1996). Bark infused in milk or whey is administered as a drench to de-worm calves (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA In Venda, it is used in magical charms (MABOGO 1990 cited in HUTCHINGS

et al. 1996).

CONSERVATION Severe damage by bark harvesting was reported in Tootabie Nature Reserve, Eastern Cape (LA COCK & BRIERS 1992).

ADDITIONAL INFORMATION

Cassine crocea

FAMILY Celastraceae

AUTHORITY (Thunb.) Kuntze

SSP TAXON

SYNONYMS *Crocoxylon croceum* (Thunb.) N. Robson, *Elaeodendron croceum* (Thunb.) DC., *Salacia zeyheri* Planch. ex Harv.

ENGLISH/AFRIKAAND red saffronwood (E), saffron wood (E), small-leaved saffron (E), fynblaarsaffraan (A), geelhout (A), geelhoutboom (A), opregtesaffraanhout (A), roisaffraan (A)

ZULU umaqunda, umbomvane

DESCRIPTION The bark is variable shades of yellow-white, smooth but typically marked by encrustations (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains tannins (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL It is used for unspecified purposes (POOLEY 1993).

USE IN SOUTHERN AFRICA Decoctions of the outer bark were traditionally used in snakebite remedies (COATES PALGRAVE 1977).

CONSERVATION It is not threatened in KwaZulu-Natal (HILTON-TAYLOR 1996).

ADDITIONAL INFORMATION

Cassine papillosa

FAMILY Celastraceae

SSP TAXON

SYNONYMS *Elaeodendron capense* Eckl. & Zeyh.

ENGLISH/AFRIKAANS common saffron (E), common saffronwood (E), saffron-red cassine (E), gewone saffraan (A)

ZULU ikhukhuze, isinama, isithundu, isithuntu, umaqunda, umbhonsi, usehlulamanye

DESCRIPTION Bark is grey, smooth, and very thin, with bright orange underbark showing through in patches; it is noticeably marked by black lenticels, and is very bitter (COATES PALGRAVE 1977). Harvested bark is readily diagnosed by the presence of calcium oxalate crystals, visible in the broken cross-section of dried material (CUNNINGHAM 2001).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The bark of *C. papillosa*, like *C. transvaalensis*, is tannin-rich, which accounts for antidiarrhoeal properties (BRUNETON 1995, VAN WYK *et al.* 1997). The phenolic elaeocyanidin, gallotannins, and ouratea proanthocyanidin A have been elucidated from the bark (VAN WYK *et al.* 1997). It contains high concentrations of calcium oxalate crystals (CUNNINGHAM 2001).

USE IN KWAZULU-NATAL It is used in remedies to clean the digestive tract, and relieve chest congestion (PUJOL 1990).

USE IN SOUTHERN AFRICA

CONSERVATION CUNNINGHAM (1988) classed *C. papillosa* as declining. It was identified by rural herbalists as among 15 species becoming increasingly scarce in KwaZulu-Natal (CUNNINGHAM 1988). It was ranked twelfth among the most frequently demanded medicinal species in KwaZulu-Natal (MANDER 1998). It is heavily exploited for bark products (Pers. comm. McKEAN 2001) but coppices well (MUIR 1990).

ADDITIONAL INFORMATION

Cassine sp.

FAMILY Celastraceae

AUTHORITY L.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS

ZULU umaqunda

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Infusions known as 'umaqunda' are used as emetics in the treatment of pleurisy (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Cassine transvaalensis

FAMILY Celastraceae

AUTHORITY (Burt Davy) Codd

SSP TAXON

SYNONYMS *Crocoxylon transvaalense* (Burt Davy) N. Robson, *Pseudocassine transvaalensis* (Burt Davy) Bredell

ENGLISH/AFRIKAANS three-petalled cassine (E), Transvaal saffron (E), Transvaal saffronwood (E), lepelhout (A), oupitjie (A), Transvaalsaffraan (A)

ZULU ingwavuma, umgududo, umgugudo, umqotha

DESCRIPTION The bark is characteristically pale grey, smooth, and may be finely fissured (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is reputedly toxic (VAN WYK *et al.* 1997). Aqueous extracts caused congestion and tanning of the abdominal wall, and cardiac arrest, in the frog species *Xenopus laevis* (HUTCHINGS *et al.* 1996). FROST (1941 cited in HUTCHINGS *et al.* 1996) identified 13.4 % catechol tannin, phytosterols, phlobaphenes, resins and brown colouring matter in the bark. Its therapeutic properties are attributed to high tannin content: tannins show antidiarrhoeal and astringent properties (BRUNETON 1995, VAN WYK *et al.* 1997). Polar extracts inhibited *Bacillus subtilis* and *Staphylococcus aureus in vitro* (McGAW *et al.* 2000). DREWES (1991 cited in HUTCHINGS *et al.* 1996) isolated dimethyl-1,3,8,10-tetrahydroxy-9-methoxypeltogynan and pentacyclic triterpenoids; the phenolic elaeocyanidin has also been isolated (VAN WYK *et al.* 1997).

USE IN KWAZULU-NATAL Infusions are administered orally or by enema as emetics for stomachache and fevers (GERSTNER 1939 cited in HUTCHINGS *et al.* 1996). This remedy is highly regarded (PALMER & PITMAN 1961). Decoctions of approximately 5 ml powdered bark in 250 ml water are taken no more than twice daily for diarrhoea and intestinal cramps, or the powder licked directly from the hand and washed down with water (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA Elsewhere in southern Africa, bark infusions are used to relieve bodily pains, stomachache, cramps, fever, diarrhoea, heavy menstruation, skin rashes and skin infections (VAN WYK & GERICKE 2000).

CONSERVATION It was noted by GERSTNER in 1938 as heavily exploited (CUNNINGHAM 1988). *C. transvaalensis* was identified by both rural and urban herbalists as one of 15 species becoming increasingly rare in KwaZulu-Natal, and was classed as declining (CUNNINGHAM 1988). It was ranked twelfth among the most frequently demanded medicinal species in KwaZulu-Natal (MANDER 1998). It is heavily exploited for bark products in KwaZulu-Natal (Pers. comm. McKEAN 2001). CUNNINGHAM (1988) reported that a 50 kg-sized bag of bark cost R 15 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal.

ADDITIONAL INFORMATION

Cassinopsis ilicifolia

FAMILY Icacinaceae

AUTHORITY (Hochst.) Kuntze

SSP TAXON

SYNONYMS *C. capensis* Sond.

ENGLISH/AFRIKAANS holly cassinopsis (E), lemon thorn (E), spiny cassinopsis (E), lemoendoring (A), lemoentijedoring (A)

ZULU ihlazane, ikhumalo, imamba eluhlaza, isanhloko, isihloko, isihlokozane

DESCRIPTION Bark is pale grey to brown; immature branches are shiny green and armed with spines (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES A benzoisoquinoline-carboline alkaloid has been isolated in unspecified plant parts (GLASBY 1991).

USE IN KWAZULU-NATAL It is used to treat dysentery (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Cassinopsis tinifolia

FAMILY Icacinaceae

AUTHORITY Harv.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS false lemon thorn (E), green snake (E), spineless cassinopsis (E), valselemoentijedoring (A)

ZULU ihlazane, ikhumalo, imamba eluhlaza, inyoka-eluhlaza, isolemamba

DESCRIPTION Bark is smooth and grey; immature stems and branches are bright green (POOLEY 1993).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It may be used in the same way as *C. ilicifolia*, to treat dysentery (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION Some vernacular names refer to the bright green colour of immature stems and branches, which resemble that of the green mamba snake (POOLEY 1993).

Cassipourea flanaganii

FAMILY Rhizophoraceae

AUTHORITY (Schinz) Alston

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS Cape onionwood (E), common onionwood (E), small-leaved bastard onionwood (E), gewone uiehout (A), Kaapse uiehout (A)

ZULU memezi, memzilobovu, umemeze obomvu, umemzilobovu, umemezobhovu

DESCRIPTION

PHYTOCHEMICAL/ PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used in medicines to heal skin diseases, and as a skin lightener (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is extensively used for cosmetic purposes in the Eastern Cape Province of (ISER 2001).

CONSERVATION It was classed as declining in KwaZulu-Natal (CUNNINGHAM 1988), and is increasingly

scarce in the Eastern Cape Province, where it is endemic (INSTITUTE OF SOCIAL & ECONOMIC RESEARCH (ISER) 2001). In Mpumalanga Province, *C. flanagani*, *C. gerrardii* and another unidentified member of the genus are considered to be in high demand, and are traded at between R 55 and R 125/kg (BOTHA *et al.* 2001).

ADDITIONAL INFORMATION There is little distinction between *C. flanagani* and *C. gerrardii* (Shinz) Alston in Zulu traditional medicine (HUTCHINGS *et al.* 1996).

Cassipourea gerrardii

FAMILY Rhizophoraceae

AUTHORITY (Shinz) Alston

SSP TAXON

SYNONYMS *C. malosana*

ENGLISH/AFRIKAANS common onionwood (E), bastard onionwood (E), lesser onionwood (E), basteruiehout (A), gewone uiehout (A), tolbollie (A)

ZULU memezi, memezilobovu, umemeze obomvu, umemezilobovu, umemezobhovu, umgamakhulu, umhlwakela, umkhathane

DESCRIPTION Bark is pale grey to grey-brown, becoming darker and rough with maturity (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Thialkaloids have been elucidated in unspecified plant parts (Glasby 1991). Compounds isolated from the bark include novel dimeric A-type proanthocyanidins (DREWES *et al.* 1996).

USE IN KWAZULU-NATAL It is used similarly to *C. flanagani*, in medicines to heal skin diseases, and as a skin lightener (PUJOL 1990 cited in HUTCHINGS *et al.* 1996). Skin lighteners are prepared with finely powdered bark, sodium carbonate and milk, and applied as a face pack (DREWES *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION CUNNINGHAM (1988) classed it as declining in KwaZulu-Natal. It is traded widely in South Africa (MANDER *et al.* 1997), and heavily exploited for bark products in KwaZulu-Natal (Pers. comm. McKEAN 2001). CUNNINGHAM (1988) reported that a 50 kg-sized bag of bark cost up to R 40 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal. In Mpumalanga Province, *C. flanagani*, *C. gerrardii* and another unidentified member of the genus are considered to be in high demand, and cost between R 55 and R 125/kg (BOTHA *et al.* 2001). Since *C. gerrardii* usually occurs in aggregated populations (CUNNINGHAM 1991); harvesting pressure affects entire populations at a time. Coppice production may be prolific (MUIR 1990).

ADDITIONAL INFORMATION There is little distinction between *C. flanagani* and *C. gerrardii* (Shinz) Alston in Zulu traditional medicine (HUTCHINGS *et al.* 1996).

Cassipourea gummiflua

FAMILY Rhizophoraceae

AUTHORITY Tul.

SSP TAXON var. *verticillata* (N.E.Br.) J. Lewis

SYNONYMS

ENGLISH/AFRIKAANS large-leaved onionwood (E), onionwood (E), grootblaaruehout (A), uiehout (A)

ZULU isinuka, isinukati, isinykani, umanuka, umbhovane, umbomvana, umbomvane, umnyamanzi

DESCRIPTION Bark is grey-brown and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES A thioalkaloid has been elucidated in unspecified plant parts (GLASBY 1991).

USE IN KWAZULU-NATAL It is used for unspecified purposes (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION In Mpumalanga Province, *C. flanagani*, *C. gerrardii* and another unidentified member of the genus are considered to be in high demand, and are traded at between R 55 and R 125/kg (BOTHA *et*

al. 2001).

ADDITIONAL INFORMATION

Catha edulis

FAMILY Celastraceae

AUTHORITY (Vahl) Forssk. ex Endl.

SSP TAXON

SYNONYMS *Methyscophyllum glaucum* Eckl. & Zeyh

ENGLISH/AFRIKAANS Abyssinian tea (E), Bushman's tea (E), boesmanstee (A), kat (A), spelonktee (A), khat (Arabic)

ZULU ingwavuma, umhlawazizi, umhlwazi, umlomomnandi, umlomomnanzi, umlomomnanzilobhovu

DESCRIPTION The bark is pale grey and smooth when immature, becoming grey to grey-brown and rough with maturity (VAN WYK *et al.* 1997). Bark on immature branches is smooth and green, sometimes pink-toned (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Chewing the leaves has become a social habit in many countries of east Africa and the Arabian Peninsula (IWU 1993). Accordingly, extensive research has been conducted on the leaves, but there is poor documentation of the bark. See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Decoctions are used as nerve tonics, cardiac stimulants, and appetite stimulants: bark is boiled in water for ten minutes, and no more than two tablespoons (22 ml) taken daily (PUJOL 1990 cited in HUTCHINGS *et al.* 1996). It is also used as a remedy for flatulence (GERSTNER 1939 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION HILTON-TAYLOR (1996) classified *C. edulis* as vulnerable in KwaZulu-Natal, and SCOTT-SHAW (1999) as lower risk.

ADDITIONAL INFORMATION

Chaetacme aristata

FAMILY Ulmaceae

AUTHORITY Planch.

SSP TAXON

SYNONYMS *Chaetacme meyeri* Harv.

ENGLISH/AFRIKAANS thorny elm (E), basterpeer (A), doringelm (A), umkaboti (A/E)

ZULU umbambangwe, umbhangbangwe, umkhovothi

DESCRIPTION Bark is pale grey, and may have single or paired spines (POOLEY 1993).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used to treat haemorrhoids (BRYANT 1966 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Cinnamomum camphora

FAMILY Lauraceae

AUTHORITY (L.) J. Presl. [E]

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS camphor tree (E), kanferboom (A)

ZULU uloselina, ulosilina, uroselina

DESCRIPTION Bark is pale brown with characteristic coarse fissures and distinctive scent (VAN WYK *et al.*

1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains the ketone camphor, which is toxic in large doses and results in respiratory failure (WATT & BREYER-BRANDWIJK 1962). It should not be used internally without supervision, and should not be used as an inhalent in young children (HUTCHINGS *et al.* 1996, VAN WYK *et al.* 1997). Natural camphor, obtained from the wood, has largely been replaced by the synthetic racemic camphor, obtained from pinene (VAN WYK *et al.* 1997). Camphor oil contains safrole, borneol, heliotropin, terpineol and vanillin (WILLIAMSON & EVANS 1998 cited in HUTCHINGS *et al.* 1996). The primary active ingredient of commercial camphor oil is (+)-(1R)-Camphor (GEORGE *et al.* 2001). Camphor has antiseptic, counter-irritant, stimulant, carminative and analeptic properties (VAN WYK *et al.* 1997). In low dosage, camphor warms and soothes the epigastric region; high dosages cause nausea, vomiting and epileptiform convulsions (HUTCHINGS *et al.* 1996). It is commonly used in modern medicine in liniments for muscle stiffness, and as a topical anti-infective and antiseptic; it is used internally as a stimulant and carminative both medically and in veterinary medicine (HUTCHINGS *et al.* 1996, VAN WYK *et al.* 1997). Synthetic camphor is used for cardiac and respiratory analeptic preparations (VAN WYK *et al.* 1997). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL It is used as emetics for love charms and perfume scent (CUNNINGHAM 1988), and is a very popular medicine (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is a popular medicine in South Africa, used for fever, colds and influenza, and to relieve abdominal discomfort (VAN WYK & GERICKE 2000).

CONSERVATION *C. camphora* was one of 15 species nominated by urban herbalists as becoming increasingly scarce in KwaZulu-Natal (CUNNINGHAM 1988), and on the Witwatersrand (WILLIAMS *et al.* 2000). A 50 kg-sized bag of bark cost R 15 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal (CUNNINGHAM 1988). In Mpumalanga Province, consumer demands are high, and bark products are traded at between R 43 and R 132/kg (BOTH A *et al.* 2001). Due to its popularity, it is sometimes cultivated at herbalists' homesteads (HUTCHINGS *et al.* 1996). Despite the perceived scarcity of the species, it is an invasive exotic (from China, Taiwan and Japan) that grows well in South Africa.

ADDITIONAL INFORMATION The vernacular name 'urosalina' is after a girls' name, due to its use as a love charm and scent (CUNNINGHAM 1988).

Cinnamomum zeylanicum

FAMILY Lauraceae

AUTHORITY (Burch.) Baill. [E]

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS

ZULU mondi, umondi

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains up to 4 % essential oil, comprising cinnamaldehyde, cinnamyl acetate, cuminaldehyde, eugenol and methyleugenol (WILLIAMSON & EVANS 1988 cited in HUTCHINGS *et al.* 1996). Other constituents include phlobatannin, mucilage, calcium oxalate and starch, and has mild astringent and anti-diarrhoeal properties (TREASE & EVANS 1983). The oil exhibits carminative, antifungal and antiviral properties, and enhances trypsin activity (HUTCHINGS *et al.* 1996). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In other parts of the region, the bark is used as a carminative (IWU 1993).

CONSERVATION

ADDITIONAL INFORMATION It is considered to be among the most important medicinal plants used in Africa (IWU 1993).

Cleisanthus schlechteri

FAMILY Euphorbiaceae

AUTHORITY (Pax) Hutch.

SSP TAXON var. *schlechteri*

SYNONYMS *C. holtzii* Pax, *Securinea schlechteri* Pax

ENGLISH/AFRIKAANS bastard tamboti (E), false tambotie (E), bastertambotie (A)

ZULU umzithi

DESCRIPTION The bark is dark grey to black-brown and roughly striated (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES A diterpenoid has been isolated in unspecified plant parts (Glasby 1991).

USE IN KWAZULU-NATAL Powdered bark is used in the treatment of burns (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Clerodendrum myrcoides

FAMILY Verbenaceae

AUTHORITY (Hochst.) Vatke

SSP TAXON

SYNONYMS *Cyclonema myrcoides* Hochst.

ENGLISH/AFRIKAANS blue cat's whiskers (E), kleinharpuisblaar (A)

ZULU umathanjana, umbozwa

DESCRIPTION Bark is grey, striated and marked with lenticels, and becomes rough with age (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Powdered bark is administered in 5 ml doses as an antidote for snakebite (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION It is among the most important medicinal plants used in Africa (IWU 1993).

Combretum caffrum

FAMILY Combretaceae

AUTHORITY (Eckl. & Zeyh.) Kuntze

SSP TAXON

SYNONYMS *C. salicifolium* E. Mey. ex Hook.

ENGLISH/AFRIKAANS bushveld willow (E), bush willow (E), Cape bushwillow (E), boswilgerboom (A), Kaapse vaderlandswilg (A), vaderlandswilgerboom (A), rooiblaar (A), rooiboswilg (A)

ZULU umdubu

DESCRIPTION Bark is grey, striated and marked with lenticels, becoming rough with age (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Antimicrobial activity has been confirmed in other members of the genus (MARTINI & ELOFF 1998). Extensive investigations have been conducted on the leaves. See TREASE & EVANS (1983), ROGERS & VEROTTA (1996) and McGAW *et al.* (2001).

USE IN KWAZULU-NATAL Rootbark is employed as a charm to harm the enemy (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Combretum molle

FAMILY Combretaceae

AUTHORITY R. Br. ex G. Don.

SSP TAXON

SYNONYMS *C. gueinzii* Sond., *C. holosericeum* Sond.

ENGLISH/AFRIKAANS velvet bushwillow (E), velvet-leaved combretum (E), basterrooibos (A), hardekool (A), rooibos (A)

ZULU umbondo (root), umbondwe (root), umbondwe-omhlope

DESCRIPTION Bark is grey, grey-brown to black, roughly fissured, and sometimes flaking (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Triterpenoids have been isolated in unspecified plant parts (GLASBY 1991). Extensive investigations have been conducted on the leaves. See TREASE & EVANS (1983), ROGERS & VEROTTA (1996), MARTINI & ELOFF (1998) and McGAW *et al.* (2001).

USE IN KWAZULU-NATAL Inner bark is infused and used for stomach complaints (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA Inner bark is infused and taken to relieve stomach complaints (COATES PALGRAVE 1977). In Venda, the bark is used to treat intestinal parasites (MABOGO 1990 cited in HUTCHINGS *et al.* 1996). In Swaziland, 30 g bark is ground with the same quantities of *Lippia javanica* Spreng. and boiled in 5 litres water for 5 minutes, and the mixture taken three times daily for five days to treat asthma (AMUSAN *et al.* 2002).

CONSERVATION

ADDITIONAL INFORMATION It is among the most important medicinal plants used in Africa (IWU 1993).

Combretum zeyheri

FAMILY Combretaceae

AUTHORITY Sond.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS large-fruited bushwillow (E), large-fruited combretum (E), raasblaar (A)

ZULU umbondwe-mhlope, umbondwe wasembundwini

DESCRIPTION The bark is grey or grey-brown, or red-toned on immature branchlets, smooth to finely fissured and flaking in small pieces resulting in a mottled appearance (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Three antimicrobial compounds were isolated from the stembark (BREYTENBACH & MALAN 1989). LINDSEY *et al.* (1999) reported *in vitro* anti-inflammatory and contraction-inducing activity. An alkaloid has been elucidated in unspecified plant parts (GLASBY 1991). See TREASE & EVANS (1983), ROGERS & VEROTTA (1996) and McGAW *et al.* (2001).

USE IN KWAZULU-NATAL It is used to treat gallstones (POOLEY 1993).

USE IN SOUTHERN AFRICA In other regions of southern Africa, decoctions are used as purgatives, in treatment of leprosy, and as a blood purifier (ROBERTS 1990).

CONSERVATION

ADDITIONAL INFORMATION

Commiphora africana

FAMILY Burseraceae

AUTHORITY (A. Rich.) Engl.

SSP TAXON

SYNONYMS *C. calciicola* Engl., *C. pilosa* (Engl.) Engl., *Heudelotia africana* A. Rich.

ENGLISH/AFRIKAANS hairy corkwood (E), poison-grub commiphora (E), harige kanniedood (A)

ZULU uminyela

DESCRIPTION The bark is grey to green, smooth, and somewhat succulent; pale gum is exuded on wounding (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Resin contains free terpenoids and terpenoid glycosides; gum contains polyholosides (HUTCHINGS *et al.* 1996). Gum resin reportedly contains 70 % resin and 29 % gum (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL Gum and resin are used to reduce fever (POOLEY 1993), and for magical purposes (HUTCHINGS *et al.* 1996). The bark is used for unspecified purposes.

USE IN SOUTHERN AFRICA It is used in washes, mixed with salt, and applied to snakebites (COATES PALGRAVE 1977).

CONSERVATION

ADDITIONAL INFORMATION

Cordyla africana

FAMILY Fabaceae - Caesalpinaceae

AUTHORITY Lour.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS wild mango (E), wildemango (A)

ZULU igowane-elikhulu, igowane-lehlati, umbhone

DESCRIPTION The bark is brown or grey and rough, and exudes a gum resin (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Isoflavonoids are present in unspecified plant parts (GLASBY 1991).

USE IN KWAZULU-NATAL It is used for unspecified purposes in northern KwaZulu-Natal (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION HILTON-TAYLOR (1996) reported that it is not threatened in KwaZulu-Natal.

ADDITIONAL INFORMATION

Croton grattissimus

FAMILY Euphorbiaceae

AUTHORITY Burch.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS Kalahari buku (E), lavender croton (E), bergboegoe (A), laventelkoorsbessie (A), leventelbos (A), macqassi (A), rekstokbos (A), stinkhout (A)

ZULU ihubeshane-elikhulu, ilabele, ilethi (leaves/stem), intumbanhlosi, liletha, liletsa, uhubeshane (root), umahlabekufeni (leaves/stem), umhluka, umhluluga

DESCRIPTION The bark is rough and grey (VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES *C. grattissimus* is reputedly toxic, and shows cathartic and irritant properties (BRYANT 1909 cited in CUNNINGHAM 1988). Toxic diterpenoids typical of *Croton* spp. cause burning in the throat and mouth (WATT & BREYER-BRANDWIJK 1962), and irritate the skin and mucosas (BRUNETON 1995). Although little is known of the chemical constituents of this species, a variety of compounds have been isolated from other members of the genus (VAN WYK *et al.* 1997). The bark contains croton and the isoquinoline alkaloid, nuciferene (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL Small pieces of bark are pulverised in approximately 125 ml milk or broth, infused, and used as a purgative for severe stomach and intestinal disorders (BRYANT 1966 cited in HUTCHINGS *et al.* 1996, CUNNINGHAM 1988). It is ground and mixed with dried root of a member of the Amaryllidaceae, and rubbed into incisions as an irritant against inflammation and chest pains (HUTCHINGS *et al.* 1996). Bark powder may also be mixed with that of *Ocotea bullata* and a little ginger [*Zingiber officinale* root?], and blown into the womb via a hollow reed, to treat uterine disorders (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA *C. grattissimus* is an important medicinal plant (used primarily for its bark) in southern Africa, due to its wide distribution in the region (VAN WYK & GERICKE 2000). Charred, powdered bark is used to brush bleeding gums (WATT & BREYER-BRANDWIJK 1962). It is also used to relieve rheumatism, chest complaints, indigestion and oedema (WATT & BREYER-BRANDWIJK 1962, PUJOL 1990 cited in VAN WYK *et al.* 1997).

CONSERVATION

ADDITIONAL INFORMATION HUTCHINGS *et al.* (1996) separated two varieties: *C. grattissimus* var. *grattissimus* and *C. grattissimus* var. *subgrattissimus*.

Croton sylvaticus

FAMILY Euphorbiaceae

AUTHORITY Hochst.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS forest croton (E), forest fever-berry (E), boskoorsbessie (A), koorsboom (A), without (A)

ZULU amahlabekufeni, indumbahlozi, minya, ugibeleweni, umgeleweni, umhlalajuba, umhloshozane, umhloshozane, uminya, ummbila, umzilanyoni

DESCRIPTION The bark is variable shades of grey, and becomes rough with maturity (COATES PALGRAVE 1977). Immature branches are covered with orange hairs (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Croton species are reputedly toxic, and medicinal use is potentially dangerous (VAN WYK *et al.* 1997). Its use as a fish poison suggests the bark has toxic properties (COATES PALGRAVE 1977). Although a variety of compounds have been isolated from other members of the genus, little is known of *C. sylvaticus* (VAN WYK *et al.* 1997). Diterpenoids typical of *Croton* spp. cause burning in the mouth and throat (WATT & BREYER-BRANDWIJK 1962), and irritation of the skin and mucosa (BRUNETON 1995). The bark is strongly aromatic (VENTER & VENTER 1996), yields 2.7 % tanning compounds (HUTCHINGS *et al.* 1996), and has shown *in vitro* anti-inflammatory activity (JÄGER *et al.* 1996).

USE IN KWAZULU-NATAL It is used in similar ways to *C. grattissimus*, in therapy of abdominal disorders, internal inflammation, dropsical swellings, uterine disorders (BRYANT 1966 cited in HUTCHINGS *et al.* 1996) and in enemas for febrile conditions (GERSTNER 1939 cited in HUTCHINGS *et al.* 1996, WATT & BREYER-BRANDWIJK 1962). Bark known as umzilanyoni, possibly *C. sylvaticus*, is boiled with salt and medicinal herbs as a tonic for listlessness (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA Like *C. grattissimus*, it is an important medicinal plant used primarily for its bark in southern Africa, due to its wide distribution in the region (VAN WYK & GERICKE 2000). Powdered bark is used in Swazi ethnoveterinary medicine to treat gallsickness in cattle (WATT & BREYER-BRANDWIJK 1962). Charred, powdered bark is used to brush bleeding gums (WATT & BREYER-BRANDWIJK 1962). It is also used to relieve rheumatism, chest complaints, indigestion and oedema (WATT & BREYER-BRANDWIJK 1962, PUJOL 1990 cited in VAN WYK *et al.* 1997).

CONSERVATION The bark is one of the most commonly stocked products on the Witwatersrand (WILLIAMS 1996).

ADDITIONAL INFORMATION

Cryptocarya latifolia

FAMILY Lauraceae

AUTHORITY Sond.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS broad-leafed quince (E), Nitonga nut (E), wild quince (E), basterswartysterhout (A), breblaarkweper (A), wildekweper (A)

ZULU umhlangwenya, umkhondweni, umngqabe, umhungwa, undlangwenya

DESCRIPTION Bark is grey-brown to pale brown, smooth but finely fissured and with occasional horizontal ridges (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains a-pyrone such as cryptofolione, but does not contain ocobullenone, the major constituent of *Ocotea bullata* (Burch.) Baill., for which *Cryptocarya* spp. are substituted (DREWES *et al.* 1996). Extracts show greater COX-1 and COX-2 inhibitory activity than *Ocotea bullata* (Burch.) Baill. bark extracts (ZSCHOCKE & VAN STADEN 2000).

USE IN KWAZULU-NATAL Ground bark is mixed with crocodile fat to treat chest complaints (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996). Muscular cramps are treated with infusions of finely powdered bark, administered morning and evening in 250 ml doses (PUJOL 1990 cited in HUTCHINGS *et al.* 1996). Decoctions are administered as enemas to treat internal pains, uterine spasm, menstrual pain and urinary tract diseases (CUNNINGHAM 1988, PUJOL 1990 cited in HUTCHINGS *et al.* 1996). It is sometimes substituted for that of *Ocotea bullata* (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION CUNNINGHAM (1988) classed it as declining in KwaZulu-Natal. It is heavily exploited for bark products in KwaZulu-Natal (Pers. comm. McKEAN 2001). It shows good coppicing ability (POOLEY 1993).

ADDITIONAL INFORMATION Large coppice leaves may be confused with *Ocotea bullata* (Burch.) Baill. (POOLEY 1993).

Cryptocarya myrtifolia

FAMILY Lauraceae

AUTHORITY Stapf

SSP TAXON

SYNONYMS *C. vacciniifolia* Stapf

ENGLISH/AFRIKAANS camphor laurel (E), camphor tree (E), myrtle quince (E), wild camphor (E), kanferboom (A), mirtekweper (A)

ZULU igqeba, umkhondweni, umngqabe

DESCRIPTION The bark is brown and smooth; immature branchlets are velvet-textured (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains a-pyrone such as cryptofolione, but does not contain ocobullenone, the major constituent of *Ocotea bullata* (Burch.) Baill., for which *Cryptocarya* spp. are substituted (DREWES *et al.* 1996). Extracts exhibit greater COX-1 and COX-2 inhibitory activity than *Ocotea bullata* (Burch.) Baill. bark (ZSCHOCKE & VAN STADEN 2000). It has a distinct camphor-like odour (COATES PALGRAVE 1977).

USE IN KWAZULU-NATAL It is used as a substitute for the bark of *Ocotea bullata* (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION *C. myrtifolia* is of lower risk conservation status in KwaZulu-Natal (SCOTT-SHAW 1999). MANDER (1998) reported that it is among the medicinal species most frequently demanded by consumers in KwaZulu-Natal. It is heavily exploited for bark products (Pers. comm. McKEAN 2001). Debarked trees do not recover easily, and coppice production from bark wounds and basal regions is poor (GELDENHUYS 2002a). Bark harvesting should be limited to narrow vertical strips to facilitate regeneration (GELDENHUYS 2002a).

ADDITIONAL INFORMATION

Cryptocarya woodii

FAMILY Lauraceae

AUTHORITY Engl.

SSP TAXON

SYNONYMS *C. acuminata* Schinz

ENGLISH/AFRIKAANS bastard camphor tree (E), Cape laurel (E), Cape quince (E), Kaapse kweper (A)

ZULU ingayi-elimnyama, isililandangulube, umnqabe

DESCRIPTION The bark is grey and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains a-pyrone such as cryptofolione, but does not contain ocobullenone, the major constituent of *Ocotea bullata* (Burch.) Baill., for which *Cryptocarya* is substituted (DREWES *et al.* 1996). Extracts exhibit much greater COX-1 and COX-2 inhibitory activity than *Ocotea bullata* (Burch.) Baill. bark (ZSCHOCKE & VAN STADEN 2000).

USE IN KWAZULU-NATAL It is used for unspecified purposes (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION It may regenerate by coppicing (MUIR (1990) reported 56 % of cut stems produced coppice shoots in Hlatikulu Forest Reserve, Maputaland). GELDENHUYS (2001) considered it a key species damaged by bark harvesting in the Umzimkulu district of KwaZulu-Natal.

ADDITIONAL INFORMATION

Cupressus sp.

FAMILY Cupressaceae

AUTHORITY L.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS

ZULU abanqongqosi

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988). The bark of an unidentified member of the genus is used as a love charm: bark is chewed, spat into the wind and the name of the loved one repeated (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Curtisia dentata

FAMILY Cornaceae

AUTHORITY (Burm f.) C.A. Sm.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS assegai (E), assegaai (A), assegaiboomb (A), assegaaihout (A)

ZULU igejalibomvu, ijundumhlahleni, inkunzitwalitshe, inphephelangeni, inphephelelangani, isejalibomvu, isitunduinkunzitwalitshe, umgxcina, umhlahlenisefile, umlahleni, umlahlenisefile, unhlibe

DESCRIPTION Bark of immature specimens is brown and smooth, becoming darker and square-fissured with maturity (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES *C. dentata*, like other members of the Cornaceae, contains tannins, which have antidiarrhoeal effects due to antiseptic and vasoconstrictor properties, and form protective layers on the skin and mucous membranes (VAN WYK *et al.* 1997). McGAW *et al.* (2000) reported antibacterial activity of polar bark extracts against *Bacillus subtilis*.

USE IN KWAZULU-NATAL It is used to treat stomach ailments and diarrhoea, and as a blood strengthener and aphrodisiac (WATT & BREYER-BRANDWIJK 1962, PUJOL 1990 cited in HUTCHINGS *et al.* 1996). It is of notable popularity in KwaZulu-Natal, but scarcity has led to its use only in 'special' bark mixes known as 'ikhubalo' (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA It is used in skin-lighteners in the Eastern Cape Province of South Africa (LA COCK & BRIERS 1992).

CONSERVATION CUNNINGHAM (1988) classified it as vulnerable and declining in KwaZulu-Natal; SCOTT-SHAW (1999) classed it as conservation-dependent in the province, and it is legally protected (SCOTT-SHAW 1999). *C. dentata* was identified by CUNNINGHAM (1988) as one of 15 species nominated by both urban and rural herbalists as becoming increasingly scarce in KwaZulu-Natal. CUNNINGHAM (1988) reported that a 50 kg-sized bag of bark cost R 30 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal, compared to R 8 in 1960. It is heavily exploited and widely traded in South Africa (MANDER *et al.* 1997). It was ranked the fifth most frequently demanded medicinal species in KwaZulu-Natal; this ranking is influenced by its occurrence in the forest biome (MANDER 1998). *C. dentata* is considered to be a reliable indicator species in the assessment of bark harvesting (LA COCK & BRIERS 1992). Prolific coppice is produced from the basal region and debarked wounds, but shoots are susceptible to browsing (CUNNINGHAM 1991, GELDENHUYS 2002a). Coppice production is best from the stump when a tree is felled (GELDENHUYS 2002a).

ADDITIONAL INFORMATION

Cussonia spicata

FAMILY Araliaceae

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS cabbage tree (E), false cabbage tree (E), lowveld cabbage tree (E), basterkiepersol (A), gewone kiepersol (A)

ZULU umbegele, umbumbu, umgezisa, umsenge, umsengembuzi

DESCRIPTION The bark is yellow-grey, thick and corky (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Anthocyanins, tannins and alkaloids have been identified in the rootbark (CHHABRA *et al.* 1984 cited in HUTCHINGS *et al.* 1996). Molluscicidal properties of the stembark are attributed to two saponins, both of which show spermicidal activity against human spermatozoides (GUNZINGER *et al.* 1986 cited in HUTCHINGS *et al.* 1996). Extracts showed antibacterial activity against *Staphylococcus aureus* but poor inhibition of the malaria parasite *Plasmodium falciparum* (TETYANA *et al.* 2000).

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA Elsewhere in South Africa, the bark is shaved and rasped for use in a hot aqueous poultice to relieve muscular spasm and cramps (ROBERTS 1990). It is used to treat malaria in Venda, Zimbabwe (MABOGO 1990 cited in HUTCHINGS *et al.* 1996). In unspecified parts of the region, it is used in therapy of stomach ulcers and for magical purposes (HUTCHINGS *et al.* 1996).

CONSERVATION

ADDITIONAL INFORMATION

Dialium schlecteri

FAMILY Fabaceae - Caesalpinaceae

AUTHORITY Harms

SSP TAXON

SYNONYMS *Andradia arborea* Sim

ENGLISH/AFRIKAANS sherbet tree (E), Zulu podberry (E), Zoeloepoulbessie (A)

ZULU umthiba

DESCRIPTION Bark is mottled pale grey and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/ PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Ground bark is used as a topical treatment for burns (PALMER & PITMAN 1961).

USE IN SOUTHERN AFRICA

CONSERVATION It is not threatened in KwaZulu-Natal (HILTON-TAYLOR 1996).

ADDITIONAL INFORMATION

Dichrostachys cinerea

FAMILY Fabaceae - Mimosaceae

AUTHORITY (L.) Wight & Arn.

SSP TAXON ssp. africana Brenan & Bumm.

SYNONYMS

ENGLISH/AFRIKAANS sickle bush (E), sekelbos (A)

ZULU igegane, ugagane, ugegane, umthezane, umzilazembe, usegwane

DESCRIPTION Bark is dark grey-brown (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES A preparation of the aqueous bark extract, for the treatment of furuncles and blennorrhoea, has been submitted for patenting (HUTCHINGS *et al.* 1996). Aqueous stembark extracts have not shown CNS-activity in rats (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used with the leaves to treat snakebite, scorpion stings, skin infections, post-partum pain, elephantiasis and as a ritual cleanser (HUTCHINGS *et al.* 1996). Inner bark is used to remedy toothache (VENTER & VENTER 1996). In Namibia, powdered bark is used to heal wounds (VAN WYK & GERICKE 2000).

CONSERVATION SHACKLETON (2000) found that coppice production may be positively manipulated with increased cutting height at which trees are felled, and stump surface area.

ADDITIONAL INFORMATION

Diospyros pallens

FAMILY Ebenaceae

AUTHORITY (Thunb.) F. White

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS bloubos (A)

ZULU umncande

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used in the treatment of dysentery (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Diospyros villosa

FAMILY Ebenaceae

AUTHORITY (L.) De Winter

SSP TAXON var. *villosa*

SYNONYMS

ENGLISH/AFRIKAANS hairy star-apple (E), shaggy diospyros (E), bloubos (A), harige ranktolbos (A), harige sterappel (A), swartbas (A)

ZULU dodemnyama, indlodlemanyama, indodemnyama, umbishimbishi, umbongisa, umqandane wesempisi, umqandane wezimpisi

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Powdered and roasted rootbark is rubbed into incisions made on fractures and

sprains (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA
CONSERVATION
ADDITIONAL INFORMATION

Dombeya rotundifolia

FAMILY Sterculiaceae

AUTHORITY (Hochst.) Planch.

SSP TAXON var. *rotundifolia*

SYNONYMS

ENGLISH/AFRIKAANS wild pear (E), wild plum (E), blomhout (A), dikbas (A), dikbasboom (A), drolpeer (A), gewone drolpeer (A)

ZULU inhlizya enkulu, isadlulambazo, linyathelolendlovu, unhliziyonkulu

DESCRIPTION The bark is dark brown, corky and furrowed; immature branches are grey, smooth but conspicuously marked by lenticels (VENTER & VENTER 1996, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES DUNCAN *et al.* (1999) reported that bark extracts show angiotensin converting enzyme (ACE) inhibitors, indicating possible usefulness in treating hypertension. Extracts of differing polarities showed antibacterial activity against *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus* and *S. epidermidis*, but bacteriostatic effects were noted only by an ethanol extract against *Micrococcus luteus* (REID *et al.* 2001). Ethanol and dichloromethane extracts exhibited high prostaglandin synthesis inhibition *in vitro*, indicative of analgesic or anti-inflammatory activity (REID *et al.* 2001). Saponins and cardiac glycosides were identified (REID *et al.* 2001).

USE IN KWAZULU-NATAL The inner bark is used for cardiac weakness (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996). Infusions are administered orally or by enema to treat intestinal ulceration (WATT & BREYER-BRANDWIJK 1962). Bark is further used in medicines for palpitations and nausea (particularly in pregnant women): decoctions are steeped and taken in doses of approximately 150 ml (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It contains tough, inflexible fibres; they are used in some parts of South Africa to bind wounds, or splints for broken limbs in humans and livestock (ROBERTS 1990). Tea made with the bark (250 ml bark boiled in 2 litres water for two hours, cooled and strained) is used to treat delayed menstruation (ROBERTS 1990), as an abortifacient or to induce labour (WATT & BREYER-BRANDWIJK 1962). In addition, the tea is used to treat palpitations, internal ulcers, nausea, stomach ailments, acute diarrhoea, haemorrhoids and chest complaints (ROBERTS 1990, VENTER & VENTER 1996, VAN WYK *et al.* 1997).

CONSERVATION

ADDITIONAL INFORMATION

Drypetes gerrardii

FAMILY Euphorbiaceae

AUTHORITY Hutch.

SSP TAXON

SYNONYMS *Drypetes gerrardii* Hutch. var. *tomentosa* Radcliffe-Sm

ENGLISH/AFRIKAANS hairy drypetes (E), bosysterpruim (A)

ZULU umhlawekele, umtwakela

DESCRIPTION The bark is grey or grey-brown and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION MUIR (1990) reported that 47 % of cut stems showed coppice regeneration at Hlatikulu Forest Reserve, Maputaland.

ADDITIONAL INFORMATION

Ekebergia capensis

FAMILY Meliaceae

AUTHORITY Sparrm.

SSP TAXON

SYNONYMS *Ekeberiga meyeri* Presl & C. DC., *Trichilia ekebergia* E. Mey ex Sond.

ENGLISH/AFRIKAANS Cape ash (E), dogplum (A), esboom (A), essenhout (A), rooiessenhout (A), rooiesshout (A)

ZULU isimanaye, linyamatsi, umathunzini, umathunzi wentaba, umathunzini-wentaba, umathunzini-wezintaba, umathuzini, umathuzini-wentaba, umgwenyana weinja, umnyamathi, umthoma, usimanaye, uvungu

DESCRIPTION PALMER & PITMAN (1961) and COATES PALGRAVE (1977) described the bark as grey-green, pale grey to black and smooth, whilst VAN WYK *et al.* (1997) noted that it is grey, rough and peeling in thick flakes. Immature branchlets are conspicuously marked by white lenticels (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The seeds contain the liminoid ekebergin, yet no liminoids were found in the bark or timber (TAYLOR 1981 cited in VAN WYK *et al.* 1997). Bark contains 7.23 % tannin (VENTER & VENTER 1996), a methyl ester of atraric acid, sitosterol, lupeol, oleanolic acid and 3-epioleanolic acid (MULHOLLAND 1996). Methanolic extracts exhibited *in vitro* antibacterial activity against *Staphylococcus aureus*, *S. epidermis* and *Bacillus subtilis* (RABE & VAN STADEN 1997). GEORGE *et al.* (2001) nominated *E. capensis* as a potentially commercial source of ekebergin for vermifuge and emetic drugs.

USE IN KWAZUL-NATAL It is traditionally used to protect chiefs against witchcraft, and used in love charm emetics (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996). It is chopped, simmered in up to 2 litres water, and the decoction taken as an emetic for heartburn, respiratory complaints and coughs (BRYANT 1966 cited in HUTCHINGS *et al.* 1996). Poultices prepared with ground bark, flour and water are applied to boils; hot water infusions are used as a wash to treat pimples, or as emetics to purify the blood (PUJOL 1990 cited in HUTCHINGS *et al.* 1996). The bark of a tree known as 'umnyamathi' - possibly *E. capensis* - is used for listlessness, exhaustion and to ward off evil (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In parts of southern Africa, it is used as an emetic, to treat dysentery, and relieve heartburn (WATT & BREYER-BRANDWIJK 1962, PUJOL 1990 cited in VAN WYK *et al.* 1997). Powdered bark infusions may be made into a paste with flour, and applied topically to abscesses, boils and acne (PUJOL 1990 cited in VAN WYK *et al.* 1997). Equal amounts of powdered bark and roots may be infused and this taken (5 ml in 125 ml water) 30 minutes before meals, to treat gastritis (PUJOL 1990 cited in VAN WYK *et al.* 1997).

CONSERVATION It is of indeterminate conservation status in KwaZulu-Natal (CUNNINGHAM 1988). It was ranked among the most frequently demanded medicinal species in KwaZulu-Natal (MANDER 1998).

ADDITIONAL INFORMATION Leaves closely resemble those of *Harpephyllum caffrum*, but *E. capensis* is distinguishable by hanging leaves, leaf scars on stems, and plum-like fruit (PALMER & PITMAN 1961, POOLEY 1993). The bark of *E. capensis* is frequently confused with that of *Harpephyllum caffrum* (Pers. comm. NDLOVU 2001), but may be diagnosed by longitudinal markings on the bark (GRANT & THOMAS 1998).

Erythrina latissima

FAMILY Fabaceae - Papilionaceae

AUTHORITY E. Mey.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS large-leaved coral tree (E), breblaarkoraalboom (A)

ZULU umgqwabagqwaba, umqonqazi

DESCRIPTION Bark is grey, slightly corky with spines on immature branches, becoming thickly corky and grooved with thorns (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is likely to contain so-called Erythrina alkaloids characteristic of the genus (VAN WYK *et al.* 1997). These are tetracyclic isoquinone alkaloids, which are highly toxic (BRUNETON 1995), but may be responsible for varied pharmacological activity of extracts (HUTCHINGS *et al.* 1996, VAN WYK *et al.* 1997). Ethanol and ethyl acetate extracts exhibited high cyclooxygenase-inhibitory activity *in vitro*, and antibacterial activity against *Staphylococcus aureus* and *Micrococcus luteus* (PILLAY *et al.* 2001).

USE IN KWAZULU-NATAL It is used as a purgative (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA Bark is burned and powdered as a topical dressing for open sores (VENTER & VENTER 1996).

CONSERVATION

ADDITIONAL INFORMATION

Erythrina lysistemon

FAMILY Fabaceae - Papilionaceae

AUTHORITY Hutch.

SSP TAXON

SYNONYMS *E. caffra* Thunb. var. *mossambicensis* Bak. f.

ENGLISH/AFRIKAANS common coral tree (E), coral tree (E), lucky bean tree (E), gewone koraalboom (A), kanniedood (A), Transvaal kafferboom (A)

ZULU umsinsi, umsisi

DESCRIPTION Bark is various shades of grey to grey-brown, smooth but with longitudinal grooves and scattered hooked thorns; immature branches are green-grey and smooth (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES So-called Erythrina alkaloids in the genus are highly toxic (VAN WYK & GERICKE 2000). These are tetracyclic isoquinoline alkaloids, such as erysovine and erythraline, which are also found in *E. lysistemon* (GAMES *et al.* 1974 cited in VAN WYK *et al.* 1997). Many pharmacological activities have been reported for the genus (HUTCHINGS *et al.* 1996, VAN WYK *et al.* 1997). Ethanol and ethyl acetate extracts exhibited high cyclooxygenase-inhibitory activity *in vitro* and antibacterial activity against *Staphylococcus aureus* and *Micrococcus luteus* (PILLAY *et al.* 2001). An isoflavone was identified as the antibacterial principle (PILLAY *et al.* 2001). Agglutination bioassays yielded negative results (GAIDAMASHVILI & VAN STADEN 2002).

USE IN KWAZULU-NATAL It is used in poultices applied to swellings and abscesses (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA *E. lysistemon* is highly respected in South Africa (ROBERTS 1990). In the eastern Transvaal, when a man dies, it is customary to plant a truncheon taken from a tree growing near his house on the man's grave (COATES PALGRAVE 1977). In other regions of this country, bark is soaked and the water used for a chief to wash, thereby ensuring the respect of his people (COATES PALGRAVE 1977). Some tribes in South Africa use strips from all four sides of the trunk to bind wild herbs together; these are used in a tea to relieve labour pains (ROBERTS 1990). ROBERTS (1990) noted that strips of bark from the branches are removed of thorns, and bound around tool handles to impart strength and soothe sore hands (ROBERTS 1990). The primary purposes for which the barks of *E. lysistemon* and *E. caffra* are use is topical application to sores, wounds (open wounds may be dressed with powdered, burnt bark), abscesses and arthritic joints (VAN WYK *et al.* 1997). The Vhavenda used the bark to treat toothache (VAN WYK & GERICKE 2000).

CONSERVATION

ADDITIONAL INFORMATION

Erythrophleum lasianthum

FAMILY Fabaceae - Caesalpiaceae

AUTHORITY Corbishley

SSP TAXON

SYNONYMS *Erythrophleum guineense* G. Don var. *swaziense* Burt Davy, *Erythrophleum suaveolens sensu* Compton

ENGLISH/AFRIKAANS red water tree (E), sasswood (E), Swazi ordeal tree (E), rooihout (A), Swazi-oordeelboom (A)

ZULU umbhemise, umhlakazane, umkhangu, umkhwangu, umkwangu

DESCRIPTION The bark is greyish-brown and rough (VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The bark and seeds contain toxic cardiac alkaloids (WATT & BREYER-BRANDWIJK 1962), and many diterpenoid alkaloids have been isolated from other members of the genus (VEROTTA *et al.* 1995 cited in VAN WYK *et al.* 1997). Cassaine and erythrophleine are noted among these, and show cardiotoxic, analgesic and vasoconstrictor effects (BRUNETON 1995, VEROTTA *et al.* 1995 cited in VAN WYK *et al.* 1997, HUTCHINGS *et al.* 1996). Furthermore, erythrophleine causes tissue dehydration, and has shown uterine stimulation, anaesthetic and haemolytic activity in rabbits (HUTCHINGS *et al.* 1996). Stermbark has anti-inflammatory properties (McGAW *et al.* 1997).

USE IN KWAZULU-NATAL Powdered bark is frequently snuffed ('mbhemiso') for headaches, migraines and less commonly hysteria (HUTCHINGS *et al.* 1996). The snuff is sometimes mixed with the powdered bark of *Warburgia salutaris* (GERSTNER 1939 and PUJOL 1990 cited in HUTCHINGS *et al.* 1996). Bark is used as both an agent, and antidote, of sorcery (GERSTNER 1939 cited in HUTCHINGS *et al.* 1996). It is taken internally for abdominal pains, used as a potent purgative, and sometimes as a poison (WATT & BREYER-BRANDWIJK 1962). Infusions of ground bark are used as emetics and enemas (PALMER & PITMAN 1961). Powdered bark is administered in limited doses (approximately 11 ml) against internal spasms (PUJOL 1990 cited in HUTCHINGS *et al.* 1996). It is used in ethnoveterinary medicine as a remedy for bovine lung sickness, and as an abortifacient for dogs (WATT & BREYER-BRANDWIJK 1962). The seed of *E. lasianthum* may be substituted for the bark, but is reputedly more toxic (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA Members of the genus have been widely used throughout Africa as ordeal poisons (WATT & BREYER-BRANDWIJK 1962). Powdered bark is snuffed to relieve headache, colds and lung sickness in cattle (COATES PALGRAVE 1977).

CONSERVATION GERSTNER noted in 1938 that it was heavily exploited (CUNNINGHAM 1988). It was nominated by both urban and rural herbalists as one of 15 increasingly scarce medicinal species in KwaZulu-Natal, and is declining in this province (CUNNINGHAM 1988). A 50 kg-sized bag of bark cost R 25 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

***Eucalyptus* sp.**

FAMILY Myrtaceae

AUTHORITY L' Hér.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS gum tree (E)

ZULU impiskayihlangulwa, umdlavusa, umdlebe

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES *Eucalyptus* oil is toxic if taken in large doses (WATT & BREYER-BRANDWIJK 1962). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL The barks of unidentified *Eucalyptus*, known as 'umdlebe' and 'umdlavusa', are used in Zulu traditional medicine; the latter is used for dysentery (DOKE & VILIKAZI 1972 cited in HUTCHINGS *et al.* 1996), and another in a facewash for acne (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA
CONSERVATION
ADDITIONAL INFORMATION

Euclea crispa

FAMILY Ebenaceae

AUTHORITY (Thunb.) Guerke

SSP TAXON ssp. *crispa*

SYNONYMS

ENGLISH/AFRIKANS blue guarri (E), blue-leaved euclea (E), bush guarri (E), bloughwarrie (A), ghwarriebos (A)

ZULU udingamuzi, isizimande, umgwali, umnqandane, umshekisane (female plant)

DESCRIPTION The bark is grey, smooth or roughened in large specimens, and may be briefly rust-toned in immature parts, due to brown granules on the bark (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Naphthoquinones are typical of the Ebenaceae (TREASE & EVANS 1983).

USE IN KWAZULU-NATAL Pieces of rootbark measuring approximately 150 mm in length are infused or simmered gently in warm water, diluted further, and administered as an enema to treat stomach disorders; the preparation cannot be taken orally as it is too potently cathartic (BRYANT 1966 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION SHACKLETON (2000) found no relationship between coppice production and the height at which trees were felled, although stump surface area influenced coppice production.

ADDITIONAL INFORMATION

Euclea natalensis

FAMILY Ebenaceae

AUTHORITY A. DC.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS large-leaved euclea (E), large-leaved guarri (E), Natal ebony (E), Natal guarri (E), bergghwarrie (A), Natalghwarrie (A), swartbasboom (A)

ZULU citha, cithamuzi, ichithamuzi (root), idungamuzi (root), ilizimane, inkunzane (root), inkunzi-emnyama (root), isinzimane (root), umhlalanyamazane, umshekisane, umzimane

DESCRIPTION The bark is grey to dark grey, smooth to rough (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The genus is known to contain naphthoquinones, and members are chemically similar to *Diospyros lycoides* and related species (TREASE & EVANS 1983, VAN WYK & GERICKE 2000). Accordingly, their use as sources of dye and toothbrush sticks can be linked to the presence of diospyron, 7-methyljugone and several other quinones (VAN WYK & GERICKE 2000). Rootbark is potently cathartic (HUTCHINGS *et al.* 1996). Extracts exhibited activity against schistosomula worms, causative of schistosomiasis (SPARG *et al.* 2000).

USE IN KWAZULU-NATAL The rootbark is employed in decoctions against scrofulous swellings (BRYANT 1966 cited in HUTCHINGS *et al.* 1996). It is also used in a mixture, known as 'imbhiza', containing roots of *Polygala fruticosa* Berg., possibly *Raphionacme* sp., bulbous roots of *Crinum* sp., and *Cyrtanthus obliquus* Ait., and the rootbarks of *Zanthoxylum capense*, *Capparis tomentosa* Lam. and *Rauvolfia caffra*. The ingredients are chopped and pounded, mixed and boiled briefly; the patient crouches over the steaming preparation until glandular swellings or tumours are drawn. Thereafter, the medicine is taken in 11 ml doses twice daily to purify the blood (HUTCHINGS *et al.* 1996). The ashes of burnt, powdered bark are made into an ointment with crocodile fat or petroleum jelly for the treatment of abnormal growths (HUTCHINGS *et al.* 1996). *E. natalensis* may be substituted for *E. crispa* in medicines for stomach disorders (HUTCHINGS *et al.*

1996). The bark of idungamuzi, possibly *E. natalensis*, is an ingredient in preparations to treat urinary tract infections, venereal disease and susceptibility to sores (HUTCHINGS *et al.* 1996). For schistosomiasis, bark is boiled, cooled and strained, and 10 ml taken three times daily (HUTCHINGS *et al.* 1996). Infusions are used as protective war charms (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In southern Africa, the rootbark is moistened and applied to the lips as a yellow-brown cosmetic (VAN WYK & GERICKE 2000). In Kaokolans, bark is chewed as a mouthwash (VAN WYK & GERICKE 2000).

CONSERVATION Coppice production may be manipulated by the cutting height at which trees are felled, although stump surface area may not strongly influence shooting (SHACKLETON 2000).

ADDITIONAL INFORMATION

Euclea schimperi

FAMILY Ebenaceae

AUTHORITY (A. DC.) Dandy

SSP TAXON var. *daphnoides* (Hiern) De Winter

SYNONYMS

ENGLISH/AFRIKAANS bush guarri (E), bosghwarrie (A), witsam (A)

ZULU amacafuthane, citha, cithamuzi, ichithamuzi, idungamuzi

DESCRIPTION Bark is grey to almost black and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Naphthoquinones are typical of the Ebenaceae (TREASE & EVANS 1983).

USE IN KWAZULU-NATAL It is used as a purgative (DOKE & VILAKAZI 1972 cited in HUTCHINGS *et al.* 1996), or infusions administered as enemas to relieve menstrual pain (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Euclea sp.

FAMILY Ebenaceae

AUTHORITY Murray

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS

ZULU inkunzi enyama, usahlulamanye

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES Naphthoquinones are typical of the Ebenaceae (TREASE & EVANS 1983).

USE IN KWAZULU-NATAL Infusions are taken as emetics for chest diseases (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Euclea undulata

FAMILY Ebenaceae

AUTHORITY Thunb.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS common guarri (E), guarri (E), thicket euclea (E), gewone ghwarrie (A), ghwarriebos (A)

ZULU gwanze, inkunzane, umbophanyamazane, umshekisane, umtshekizane

DESCRIPTION Bark is grey and scaly; younger parts may be covered with a granular rust-coloured exudate from glands on the leaves and branches (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Naphthoquinones are typical of the Ebenaceae (TREASE & EVANS 1983). Bark contains 3.26 % tannin (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used by the Sotho to relieve headaches: powdered bark is applied to a strip of *Dombeya rotundifolia* leaf and the head bandaged (WATT & BREYER-BRANDWIJK 1962). Infusions of the rootbark are potent purgatives (WATT & BREYER-BRANDWIJK 1962).

CONSERVATION

ADDITIONAL INFORMATION Two varieties have been described: var. *undulata* (common guarri), and var. *myrtina* (small-leaved guarri) (VON BREITENBACH 1986 cited in VAN WYK *et al.* 1997).

Euphorbia ingens

FAMILY Euphorbiaceae

AUTHORITY E. Mey. ex Boiss.

SSP TAXON

SYNONYMS *E. natalensis sensu* Berg. *non* Bernh., *E. similis* Berg.

ENGLISH/AFRIKAANS candelabra tree (E), common tree euphorbia (E), gewone naboom (A), kankerbos (A), naboom (A), noorsboom (A), noorsdoringboom (A)

ZULU umahetheni, umhlonhlo, umphapha

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES The latex is toxic: contact results in acute irritation and blistering of the skin, and, should it come into contact with the eyes, results in short-term or permanent blindness; reports suggest similar reactions in cattle (COATES PALGRAVE 1977). Use as a fish poison further confirms its toxicity (COATES PALGRAVE 1977).

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA The Vhavenda people in South Africa use it to treat chronic ulcers and cancer (MABOGA 1990 cited in HUTCHINGS *et al.* 1996). Despite its well-known toxicity, the latex is administered in small doses as a purgative, and to treat dypsomania and cancer (COATES PALGRAVE 1977). Symptoms of over-dose include vomiting and violent abdominal pain (COATES PALGRAVE 1977).

CONSERVATION

ADDITIONAL INFORMATION

Faidherbia albida

FAMILY Fabaceae - Mimosaceae

AUTHORITY (Del.) A. Chev.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS ana tree (E), anaboom (A)

ZULU umhlalankwazi, umkhaya-womfula

DESCRIPTION Bark is green-grey to pale grey and smooth, becoming increasingly dark and rough with maturity (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (POOLEY 1993).

USE IN SOUTHERN AFRICA Decoctions may be used to stop bleeding, relieve inflamed eyes, or as an emetic taken orally (VENTER & VENTER 1996). The Topnaar people of Namibia use strips of bark as dental floss (VAN WYK & GERICKE 2000). Decoctions are used in unspecified regions to treat diarrhoea (VAN

WYK & GERICKE 2000).

CONSERVATION

ADDITIONAL INFORMATION

Faurea macnaughtonii

FAMILY Proteaceae

AUTHORITY Phill.

SSP TAXON

SYNONYMS *F. natalensis* Phill.

ENGLISH/AFRIKAANS terblans (E/A), bosboekenhout (A), Egossa-beuke (A), rooiboekenhout (A)

ZULU isefu, isiqalaba, isisefo

DESCRIPTION Bark is thick, grey and longitudinally fissured (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION CUNNINGHAM (1988) classed it as vulnerable and declining in KwaZulu-Natal, and SCOTT-SHAW (1999) as lower risk, but protected. The species is extremely sensitive to bark removal (CUNNINGHAM 1991), and bark wounds are highly susceptible to fungal infection (CUNNINGHAM 2001). Coppice production is poor (CUNNINGHAM 1991).

ADDITIONAL INFORMATION

Faurea saligna

FAMILY Proteaceae

AUTHORITY Harv.

SSP TAXON

SYNONYMS *Protea blousii* Phill., *P. multibracteata* Phill., *P. rhodantha* Hook.f.

ENGLISH/AFRIKAANS African red beech (E), beechwood (E), red beech (E), Transvaalboekenhout (A)

ZULU isiqalaba, isisefo

DESCRIPTION Bark is dark grey-brown to black, rough and deeply longitudinally fissured (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Bark contains tannins (PALMER & PITMAN 1961).

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In Venda, the bark is used to treat venereal diseases and schistosomiasis (HUTCHINGS *et al.* 1996).

CONSERVATION It is of indeterminate conservation status in KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Ficus ingens

FAMILY Moraceae

AUTHORITY (Miq.) Miq.

SSP TAXON var. *ingens*

SYNONYMS *F. ingens* Miq. var. *tomentosa* Hutch.

ENGLISH/AFRIKAANS red-leaved rock fig (E), red leaf wild fig (E), wild fig (A), rooiblaarrotsky (A), wildevyboom (A)

ZULU inkokhokho, isigondwane, umdende, umdende-obomvu, umgonswane

DESCRIPTION Bark is grey to yellow-grey and smooth (COATES PALGRAVE 1977), peeling in small, thin flakes (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains tannins (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL Decoctions are used to treat anaemia, and as a galactagogue for cows (WATT

& BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA The Vhavenda use the bark in the same way as the Zulu (MABOGO 1990 cited in HUTCHINGS *et al.* 1996). The milky latex is used as a disinfectant (VENTER & VENTER 1996).

CONSERVATION Latex-producing *Ficus* spp. are resilient to harvesting pressure, may exhibit regrowth after complete bark removal (CUNNINGHAM & MBENKUM 1993) and coppice well (MUIR 1990).

ADDITIONAL INFORMATION

Ficus natalensis

FAMILY Moraceae

AUTHORITY Hochst.

SSP TAXON *spp. natalensis*

SYNONYMS

ENGLISH/AFRIKAANS common wild fig (E), Natal fig (E), rock-splitting fig (E), tree-killer (E), wild fig (E), bostouboom (A), gewone wildevy (A), natou (A), t'kaa (A)

ZULU idende, isihlamfane, uluzi, umbombe, umdende, umthombe

DESCRIPTION The bark is grey and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is an ingredient in 'inembe', an infusion taken regularly during pregnancy to ease childbirth (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION Latex producing *Ficus* spp. are resilient to harvesting pressure, may exhibit regrowth after complete bark removal (CUNNINGHAM and Mbenkum 1993) and coppice well (MUIR 1990).

ADDITIONAL INFORMATION

***Ficus* sp.**

FAMILY Moraceae

AUTHORITY (Miq.) Miq.

SSP TAXON

SYNONYMS *F. soldanella* (*sensu* HUTCHINGS *et al.* 1996).

ENGLISH/AFRIKAANS rock fig (E), tree-killer (E), klipvy (A), rankvy (A), rotsvy (A)

ZULU impayi, umluga

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Decoctions are taken by men as a strengthening tonic (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION Latex producing *Ficus* spp. are resilient to harvesting pressure, may exhibit regrowth after complete bark removal (CUNNINGHAM and Mbenkum 1993) and coppice well (MUIR 1990).

ADDITIONAL INFORMATION

Ficus sur

FAMILY Moraceae

AUTHORITY Forssk.

SSP TAXON

SYNONYMS *F. capensis* Thunb., *F. mallotocarpa* Warb.

ENGLISH/AFRIKAANS broom cluster fig (E), bush fig (E), Cape fig (E), besemtrosvy (A), bosvy (A), grootvy (A), komaan (A), koomaan (A), suurvy (A)

ZULU ingobozeni, intombi-kayibhinci, umkhiwane

DESCRIPTION Bark is smooth and pale grey (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES *F. sur* reportedly contains 0.18 % rubber latex (WATT & BREYER-BRANDWIJK 1962). The bark contains resin and tannins (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL It is decocted and used to treat suspected pulmonary tuberculosis (WATT & BREYER-BRANDWIJK 1962). Infusions are used as galactogogues for cows (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In various regions of southern Africa, infusions are taken as galactogogues, and to relieve constipation in both humans and animals (VAN WYK & GERICKE 2000). Powdered bark is applied topically to treat skin rashes (VAN WYK & GERICKE 2000).

CONSERVATION Latex producing *Ficus* spp. are resilient to harvesting pressure, may exhibit regrowth after complete bark removal (CUNNINGHAM and Mbenkum 1993), and coppice well (MUIR 1990).

ADDITIONAL INFORMATION

Garcinia gerrardii

FAMILY Ochnaceae

AUTHORITY Harv. ex. Sim

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS forest garcinia (E), forest mangosteen (E), bosgeelmelkhout (A), ebbhout (A)

ZULU isibinda, isikhwelamfene, umbinda

DESCRIPTION The bark is dark grey to brown, sometimes vertically ridged (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains 11.3 % tannins (WATT & BREYER-BRANDWIJK 1962). Rootbark has shown antifungal activity against *Cladosporium cucumerinum*, and the active principle identified as a prenylated xanthone (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL It is used in sprinkling charms against lightning (PUJOL 1990).

USE IN SOUTHERN AFRICA

CONSERVATION *G. gerrardii* is declining in KwaZulu-Natal (CUNNINGHAM 1988). A 50 kg-sized bag of bark cost R 10 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Garcinia livingstonei

FAMILY Ochnaceae

AUTHORITY T. Anders

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS African mangosteen (E), Livingstone's garcinia (E), lowveld mangosteen, laeveldse geelmelkhout (A)

ZULU isihlumanye, ugobandlovu, umphimbi

DESCRIPTION The bark is yellow-grey to dark grey, rough and cracked in squares; bark on immature branches is smooth and glossy (COATES PALGRAVE 1977, VENTER & VENTER 1996). All parts exude sticky, pale yellow sap (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The rootbark has shown antifungal activity against *Cladosporium cucumerinum*, and inhibition of human colon carcinoma cell lines; these properties are attributable to prenylated xanthenes (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Gardenia ternifolia

FAMILY Rubiaceae

AUTHORITY Schumach. & Thonn.

SSP TAXON ssp. *jovis-tonantis* (Welw.) Verdc. var. *goetzei* (Stapf. & Hutch.) Verdc.

SYNONYMS

ENGLISH/AFRIKAANS large-leaved common gardenia (E), large-leaved Transvaal gardenia (E), geelkatjiepiering (A)

ZULU umkwakane omkhulu

DESCRIPTION Bark is grey or yellow-brown and smooth; branches are covered in rust-coloured powder (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In Zimbabwe the bark is an ingredient of ointments used in therapy of convulsions (HUTCHINGS *et al.* 1996).

CONSERVATION

ADDITIONAL INFORMATION

Gardenia thunbergii

FAMILY Rubiaceae

AUTHORITY Thunb.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS white gardenia (E), buffelsbal (A), kannetjieberoom (A), swartbas (A), wildekatjiepiering (A), witkatjiepiering (A)

ZULU umkangaze (root), umkhangazo (root), umkwakwane omkhulu

DESCRIPTION Bark is pale grey and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Rootbark infusions are used as emetics for biliousness (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION It is readily cultivated from seed or truncheons (POOLEY 1993), and is slow growing but hardy (COATES PALGRAVE 1977).

ADDITIONAL INFORMATION

Gardenia volkensii

FAMILY Rubiaceae

AUTHORITY K. Schum.

SSP TAXON ssp. *spatulifolia* (Stapf. & Hutch.) Verdc.

SYNONYMS

ENGLISH/AFRIKAANS common gardenia (E), savanna gardenia (E), Transvaal gardenia (E), savannekatjiepiering (A), stompdoring (A), Transvaalkatjiepiering (A)

ZULU umgongwane, umkwakwane omkhulu, umvalasangweni (root)

DESCRIPTION The bark is pale grey and smooth, becoming mottled yellow-green due to flaking (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA Ointments are used in Zimbabwe in therapy of convulsions (HUTCHINGS *et al.* 1996).

CONSERVATION

ADDITIONAL INFORMATION

Gerrardina foliosa

FAMILY Flacourtiaceae

AUTHORITY Oliv.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS krantz berry (E), kransbessie (A)

ZULU ilethi, isidlulamanye, umaluleka, umlulama, umlulama womfula, umuthi wokuzila

DESCRIPTION Bark is dark grey to brown and rough (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Rootbark is used to treat coughs, colds and headaches (GERSTNER 1939 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION It is rare and vulnerable in KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Grewia caffra

FAMILY Tiliaceae

AUTHORITY Mesin.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS climbing raisin (E), climbing grewia (E), doringtou (A), rankrosyntjie (A)

ZULU iklolo, ilalanyathi, iphata, isaka, isilandula, umlalanyate

DESCRIPTION Bark is dark brown and roughly textured (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Rootbark is used for bladder ailments and in enemas (GERSTNER 1939 cited in HUTCHINGS *et al.* 1996). Pounded stembark is used in soap that is believed to prevent the hair from greying (HULME 1954 cited in HUTCHINGS *et al.* 1996). A dressing for wounds is made from bark that is bruised and soaked in hot water (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Grewia occidentalis

FAMILY Tiliaceae

AUTHORITY L.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS assegai wood (E), cross-berry (E), kruisbessie (A)

ZULU iklolo, ilalanyathi, imahlele, umlalanyathi, umnqabaza

DESCRIPTION The bark is pale grey to grey-brown and smooth (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Bark contains tannin and mucilage or gum (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL Rootbark is used to treat bladder complaints, and in infusions administered as enemas (GERSTNER 1939 cited in HUTCHINGS *et al.* 1996). Pounded bark is used in soaps to wash the head, which are believed to prevent hair from greying (HULME 1954 cited in HUTCHINGS *et al.* 1996). Bark is bruised and soaked in water prior to use in dressings for wounds (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA
CONSERVATION
ADDITIONAL INFORMATION

Greyia sutherlandii

FAMILY Greyiaceae

AUTHORITY Hook. & Harv.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS Natal bottlebrush (E), Natalse baakhout (A)

ZULU indalu, indulo, isidwadwa, umbande, umbunge

DESCRIPTION Bark is dark red-grey and rough on maturity, but smooth red-grey when young (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Harpephyllum caffrum

FAMILY Anacardiaceae

AUTHORITY Bernh. ex Krauss

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS essenhout (E), wild plum (E), kafferpruim (A), suurbessie (A), wildepruim (A)

ZULU umgwenya

DESCRIPTION The bark is dark brown and rough, resembling the skin of a crocodile (umgwenya) in mature specimens; bark on immature branches is dark grey and smooth with leaf scars (VENTER & VENTER 1996, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Polyphenolics and flavonoids, including protocatechuic acid and the flavonol kaempferol, have been identified (VAN WYK *et al.* 1997). Members of the Anacardiaceae are known to produce 5-deoxyflavonoids and biflavonyls (HUTCHINGS *et al.* 1996). Tanniferous parenchyma produces anthocyanins, gallic acid and calcium oxalate crystals; silica may be present in the xylem, and allergenic or toxic resin is common (HUTCHINGS *et al.* 1996). JÄGER *et al.* (1996) reported anti-inflammatory activity, and McGAW *et al.* (2000) reported antibacterial activity of polar extracts against *Bacillus subtilis*, *Escherichia coli*, *Klebsiella pneumoniae* and *Staphylococcus aureus*.

USE IN KWAZULU-NATAL Decoctions are used as emetics to purify the blood, and for skin complaints such as acne and eczema; oral dosage is 250-500 ml daily, or greater volumes for administration by enema (PUJOL 1990 cited in HUTCHINGS *et al.* 1996). Burnt bark is powdered and rubbed into scarifications made around sprains and fractures (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In southern Africa, it is a popular traditional medicine and cosmetic for facial saunas (VAN WYK & GERICKE 2000). Decoctions are taken for rashes seemingly contracted from river sprites (HUTCHINGS *et al.* 1996).

CONSERVATION CUNNINGHAM (1988) classed it as declining in KwaZulu-Natal. It was jointly ranked eleventh of the medicinal species most frequently demanded by consumers in KwaZulu-Natal (MANDER 1998).

ADDITIONAL INFORMATION Due to similarities in leaf morphology, it is frequently confused with *Ekebergia capensis* Sparrm. It may be distinguished by firm, not drooping leaves (as in *E. capensis*), sickle-shaped leaflets, less scarred bark, and elongated fruit (PALMER & PITMAN 1961).

Heteromorpha trifoliata

FAMILY Apiaceae

AUTHORITY (Wendl.) Eckl. & Zeyh.

SSP TAXON

SYNONYMS *Bupleurum arborescens* Thunb., *B. trifoliatum* Wendl., *Harpephyllum arborescens* (Thunb.) Cham. & Schlechtd.

ENGLISH/AFRIKAANS parsley tree (E), parsnip tree (E), kraaibos (A), stinkbos (A), wildepieterseliebos (A)

ZULU umbangabdlala

DESCRIPTION The bark is red-brown to purple-brown, smooth and waxy in appearance, and typically peeling in paper-like flakes (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Milky latex exuded by the plant has shown antimicrobial activity (DESTA 1993 cited in HUTCHINGS *et al.* 1996).

USE IN KWAZUL-NATAL It is used against colic, scrofula and in ethnoveterinary medicine in an equine vermifuge (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In Lesotho, it is used to treat depressed fontanelles in infants (WATT & BREYER-BRANDWIJK 1962).

CONSERVATION

ADDITIONAL INFORMATION

Heteropyxis natalensis

FAMILY Myrtaceae

AUTHORITY Harv.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS lavender tree (E), lemon verbena (E), laventelboom (A)

ZULU inkunzi, uhuza, uhuze, uhuzu, umkhuswa, umkhuswe

DESCRIPTION Bark is distinctively pale grey to pale brown, almost white and thinly flaking; this results in a characteristic mottled appearance (COATES PALGRAVE 1977, VENTER & VENTER 1996, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Many compounds have been elucidated from the essential oil (VAN WYK *et al.* 1997).

USE IN KWAZULU-NATAL It is powdered and licked off the fingers as an aphrodisiac and to cure impotence (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION MANDER (1998) ranked *H. natalensis* thirteenth among the most frequently demanded medicinal species in KwaZulu-Natal.

ADDITIONAL INFORMATION

Homalium dentatum

FAMILY Flacourtiaceae

AUTHORITY (Harv.) Warb.

SSP TAXON

SYNONYMS *Blackwellia dentata* Harv.

ENGLISH/AFRIKAANS brown ironwood (E), common homalium (E), forest homalium (E), white ironwood (E), basterwitstinkhout (A), bosbastermoerbe (A), bruinysterhout (A)

ZULU idlebendlovu, idlebendlovu enkulu, umkhakhasi, umqathe

DESCRIPTION The bark is grey and smooth, but in immature branches it is dark brown and conspicuously marked by pale lenticels (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Powdered bark is used in colic remedies (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Ilex mitis

FAMILY Aquifoliaceae

AUTHORITY (L.) Radlk.

SSP TAXON var. *mitis*

SYNONYMS *I. capensis* Sond.

ENGLISH/AFRIKAANS African holly (E), Cape holly (E), waterboom (A), without (A)

ZULU iphuphuma, isidumo, umdumo, umdumowazo

DESCRIPTION The bark is pale grey to light brown and smooth, and purple-toned and marked by lenticels on immature branches (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Infusions are used to reduce fever (GERSTNER 1939 cited in HUTCHINGS *et al.* 1996), as emetics in the treatment of diarrhoea, and for the same purpose in livestock (WATT & BREYER-BRANDWIJK 1962). It is pounded and the resultant lather used to wash influenza patients (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA Small pieces of bark are chewed for mild purgative effects, and in enemas to treat colic in children (COATES PALGRAVE 1977). Decoctions of powdered bark are taken orally as emetics; pastes made with powdered bark are applied topically to rashes and facial sores (HUTCHINGS *et al.* 1996).

CONSERVATION It is of indeterminate conservation status in KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION The Zulu vernacular name used for an unidentified member of the genus is 'citha'.

Kigelia africana

FAMILY Bignoniaceae

AUTHORITY Lam. (Benth.)

SSP TAXON

SYNONYMS *Kigelia pinnata* DC.

ENGLISH/AFRIKAANS sausage tree (E), komkommertboom (A), kalabasboom (A), worsboom (A)

ZULU ibele-ndlovu, ubongothi, umfongothi, umvongothi (fruits), umvunguta, umzingula, umzingulu

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES Aqueous extracts exhibited antibacterial and antifungal activity against *Candida albicans*, *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli* and *Pseudomonas aeruginosa*; activity was attributed to iridoids, dihydroisocoumarins and their glycosides, and naphthoquinones (GOVINDACHARI *et al.* 1971, INOUE *et al.* 1981, AKUNYILI *et al.* 1991, VAN WYK *et al.* 1997). Aqueous, ethanol and ethyl acetate extracts have also shown antibacterial activity against *Klebsiella pneumoniae* (GRACE *et al.* 2002). Isolated compounds isopinnatal and lapachone are active against trypanosomes (ANONYMOUS 1993). *In vitro* activity of extracts against melanoma and renal cell carcinoma lines may justify its reputed efficacy against skin melanoma; this supports its use in South Africa for the treatment of 'skin cancer' (HOUGHTON *et al.* 1994, ANONYMOUS 1995, HOUGHTON 2002). Bark extracts and isolated compound lapachol have shown cytotoxicity against *Artemia salina* in the brine shrimp bioassay, indicating anti-tumour potential (KHAN & MLUNGWANA 1999). Anticonvulsant properties may be attributable to cinnamic acid (HUTCHINGS *et al.* 1996). Compounds elucidated include 3-dimethylkigelin, ferulic acid, kigelinone, pinnatal, isopinnatals, dihydroisocoumarins, sterols (GOVINDACHARI *et al.* 1971, INOUE *et al.* 1981, BRUNETON 1995). BURKILL (1985) reported tannic acid. It has a somewhat bitter taste,

and is reported to contain a bitter principle (WATT & BREYER-BRANDWIJK 1962, AKAH 1996).

USE IN KWAZULU-NATAL Decoctions are administered orally or by enema to adults and paediatric patients, as a stomach palliative and laxative (HUTCHINGS *et al.* 1996, VAN WYK *et al.* 1997).

USE IN SOUTHERN AFRICA Decoctions are used to treat venereal diseases (IMMELMAN *et al.* 1973, COATES PALGRAVE 1977, HUTCHINGS *et al.* 1996). In Zimbabwe, decoctions are gargled to relieve pain and inflammation caused by toothache, or taken orally to prevent epileptic fits and treat pneumonia (GELFAND *et al.* 1985). Extracts are potent cures for skin melanoma in fair-skinned people (HOUGHTON *et al.* 1994). Decoctions are administered orally as abortifacients (HUTCHINGS *et al.* 1996).

CONSERVATION It is considered occasional in most parts of Africa, but not threatened (MAUNDU *et al.* 1997). It is readily cultivated from seed or truncheons (POOLEY 1993).

ADDITIONAL INFORMATION

Lannea discolor

FAMILY Anacardiaceae

AUTHORITY (Sond.) Engl.

SSP TAXON

SYNONYMS *Odina discolor* Sond.

ENGLISH/AFRIKAANS live-long (E), dikbas (A)

ZULU isiganganyane

DESCRIPTION Bark is grey with a copper sheen, and may be smooth or slightly rough (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (POOLEY 1993).

USE IN SOUTHERN AFRICA In some regions of southern Africa, it is used in therapy of paediatric complaints, such as fever and constipation (COATES PALGRAVE 1977). Powdered bark is administered orally to treat diarrhoea (HUTCHINGS *et al.* 1996).

CONSERVATION

ADDITIONAL INFORMATION

Lannea schweinfurthii

FAMILY Anacardiaceae

AUTHORITY (Engl.) Engl.

SSP TAXON var. *stuhlmannii* (Engl.) Kokwaro

SYNONYMS *L. kirkii* Burt Davy, *L. stuhlmannii* (Engl.) Engl.

ENGLISH/AFRIKAANS false marula (E), bastermaroela (A)

ZULU umganukomo

DESCRIPTION Bark is light brown or grey, flaking in rectangular pieces and revealing pale orange underbark; this produces a mottled effect (COATES PALGRAVE 1977). Bark on immature branches is green, pubescent and marked by conspicuous leaf scars (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA The Swahili use finely powdered rootbark, blown into the nasal cavities of a snakebite victim, when the patient begins to lose consciousness (WATT & BREYER-BRANDWIJK 1962). The Vhavenda people use rootbark decoctions mixed with a fungus found on the roots of *L. schweinfurthii* to help family members forget a recently deceased relative (MABOGA 1990 cited in HUTCHINGS *et al.* 1996). The bark is also used to treat headaches, stomach pains, sleeping sickness, and to help people disregard unpleasant events (HUTCHINGS *et al.* 1996).

CONSERVATION In Mpumalanga Province, *L. schweinfurthii* var. *stuhlmannii* is considered to be readily available and in high demand; bark products are traded for an average price of R 500/kg (BOTH A *et al.* 2001).

ADDITIONAL INFORMATION

Lonchocarpus capassa

FAMILY Fabaceae - Papilionaceae

AUTHORITY Rolfe

SSP TAXON

SYNONYMS *Capassa violacea* Klotzsch, *Derris violacea* (Klotzsch) Harms, *L. violaceus* (Klotzsch) Oliv.

ENGLISH/AFRIKAANS apple-leaf (E), lance tree (E), Panda tree (E), rain tree (E), appelblaar (A), olifantsoor (A), raasboom (A), stamperhout

ZULU isihomohomo, umbandu, umbhandu, umphanda

DESCRIPTION The bark is creamy-brown or grey in colour, smooth to cracked and flaking; immature branches are densely pubescent (COATES PALGRAVE 1977, VENTER & VENTER 1996). Sticky red sap is exuded from bark wounds (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is reputedly extremely toxic (HUTCHINGS *et al.* 1996). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Infusions for dysentery are administered in approximately 11 ml doses (GELFAND *et al.* 1985).

USE IN SOUTHERN AFRICA The stem bark is used as a laxative, to treat skin diseases, reduce fevers, and in therapy of convulsion (IWU 1993). Powdered bark is used to treat snakebite (VENTER & VENTER 1996). In Swaziland, 50 g bark is added to 5 litres warm water, and the preparation taken when necessary to treat hallucination (AMUSAN *et al.* 2002).

CONSERVATION In Mpumalanga Province, it is considered to be in high demand and readily available (BOTHA *et al.* 2001).

ADDITIONAL INFORMATION

Loxostylis alata

FAMILY Anacardiaceae

AUTHORITY Spreng. f. ex Reichb.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS Loxostylis (E), tarwood (E), wild pepper tree (E), teerhout (A), tierhout (A)

ZULU ifuthu, isibara, ufutho, ufuthu

DESCRIPTION The bark is pale grey, flaking, and characterised by vertical fissures (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Ginkgol and ginkgolic acid have been elucidated DREWES *et al.* 1998).

USE IN KWAZULU-NATAL It is a commonly used medicine, particularly in childbirth (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION It is vulnerable and declining in KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Macaranga capensis

FAMILY Euphorbiaceae

AUTHORITY (Baill.) Benth. ex Sim

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS spiny macaranga (E), swamp poplar (E), wild poplar (E), wildepopulier (A)

ZULU iphubane, iphumela, umbhongabhonga, umfongafonga, umfongofongo, umompumelelo, umphumela, umphumelele, umpumelelo

DESCRIPTION The bark is pale grey to light brown and smooth; the trunk and branches may be armed with spines (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used to treat skin diseases and relieve sunburn (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION MANDER (1998) ranked it among the most frequently demanded medicinal plants in KwaZulu-Natal.

ADDITIONAL INFORMATION

Maesa lanceolata

FAMILY Myrsinaceae

AUTHORITY Forssk.

SSP TAXON

SYNONYMS *M. angolensis* Gilg., *M. lanceolata* Forssk. var. *rufescens* (A. DC.) Taton, *M. rufescens* A. DC.

ENGLISH/AFRIKAANS false assegai (E), maesa (E), basterassegai (A), bruinsapblaar (A)

ZULU isidenda (root, bark), isithende, maguqu, ubhoqobhoqo, ugupu (root, bark), uhlamvubele, umagugu (root, bark), umagupu, umaguqu, umaququ, umphongaphonga, uphophopho

DESCRIPTION Bark is grey, grey-brown or red-brown and is rather tough, although young branches are smooth and may be covered with soft, rust-coloured pubescence (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The bark has a sharp taste (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL The rootbark is used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA In some parts of southern Africa, it is used to treat jaundice and to make an invigorating beverage (COATES PALGRAVE 1977).

CONSERVATION In Mpumalanga Province, bark products are sold for between R 23 and R 93/kg (BOTH A *et al.* 2001).

ADDITIONAL INFORMATION

Manilkara concolor

FAMILY Sapotaceae

AUTHORITY (Harv. ex C.H. Wr.) GERSTNER

SSP TAXON

SYNONYMS *Mimusops concolor* Harv. ex C.H. Wr.

ENGLISH/AFRIKAANS Zulu milkberry (E), Zoeloemelkbessie (A)

ZULU amasethole amhlope, umncambu, umnqabo

DESCRIPTION Bark is grey, brown or black, and corky with deep longitudinal fissures; branches are grey and fissured (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Decoctions of the rootbark are administered as an enema to treat backache; this is reputedly a potent medicine (PALMER & PITMAN 1961).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Manilkara discolor

FAMILY Sapotaceae

AUTHORITY (Sond.) J.H. Hemsl.

SSP TAXON

SYNONYMS *Muriea discolor* (Sond.) Hartog

ENGLISH/AFRIKAANS forest milkberry (E), red milkwood (E), bosmelkbessie (A), rooimelkhou (A)

ZULU umnqambo, umnwebe (root), umweba, umweba-wentaba

DESCRIPTION Bark is brown to dark grey, roughly textured with longitudinal fissures, and shallowly fissured at the base in large specimens (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used similarly to *M. concolor*, to treat backache and brittle bones (PALMER & PITMAN 1961, POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Manilkara mochisia

FAMILY Sapotaceae

AUTHORITY (Bak.) Dubard

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS lowveld milkberry (E), laeveldmelkbessie (A)

ZULU inqozi, nwamba, umncambu, umnquambo

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It may be used in the same ways as *M. concolor* and *M. discolor* (HUTCHINGS *et al.* 1996) to treat backache and brittle bones.

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Maytenus acuminata

FAMILY Celastraceae

AUTHORITY (L.f.) Loes.

SSP TAXON var. *acuminata*

SYNONYMS

ENGLISH/AFRIKAANS silky bark (E), olifantshout (A), rooisybas (A), rooisybasboom (A), sybas (A), sybasboom (A)

ZULU inama, isinama, isinama-elimhlope, umlulama, umnama

DESCRIPTION The bark is grey to brown and smooth (COATES PALGRAVE 1977). Elastic threads are visible when bark is broken (CUNNINGHAM 2001).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used to treat stomach ailments (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Maytenus heterophylla

FAMILY Celastraceae

AUTHORITY (Eckl. & Zeyh.) N.K.B. Robson

SSP TAXON

SYNONYMS *Celastrus buxifolius* L., *C. heterophyllus* Eckl. & Zeyh., *C. lanceolatus* E. Mey. ex Sond., *C. linearis* L.f., *Gymnosporia buxifolia* (L.) Szyszyl., *G. crataegiflora* Davidson, *G. lanceolata* (E. Mey. ex Sond.) Loes., *G. linearis* (L.f.) Loes., *Maytenus cymosa* (Soland.) Exell

ENGLISH/AFRIKAANS common spike-thorn (E), spike thorn (E), gewone pendoring (A), gifdoring (A), lemoending (A), pendoring (A)

ZULU ingqowangane, ingqwangane yehlanze, isibhubu, isibulu, isihlangu, umkhokhozo, umquqo, usala, usolo

DESCRIPTION Bark is pale or dark grey with striations; bark on immature branches show brown, green or reddish-purple colouring, and spines typically 3-4 cm in length but occasionally up to 24 cm long (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Compounds isolated include the spermidine alkaloid celacinnine and triterpenoids such as epifriedelanol, friedelin and epfriedelinol (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL Infusions are used as emetics in the treatment of diarrhoea, and for the same purpose in livestock (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Maytenus undata

FAMILY Celastraceae

AUTHORITY (Thunb.) Blakelock

SSP TAXON

SYNONYMS *Celastrus undatus* Thunb., *C. zeyheri* Sond., *Gymnosporia albata* (N.E. Br.) Sim, *G. deflexa* Sprague, *G. fasciculata* (Tul.) Loes., *G. undata* Thunb. Szyszyl., *G. zeyheri* (Sond.) Szyszyl.

ENGLISH/AFRIKAANS koko tree (E), South African holly (E), kokoboom (A), saffraan (A), Transvaal saffraanhout (A)

ZULU dabulaluvulo, idohame, igqwabali, ikhukhuze, indabulovalu, inqayi-elibomvu

DESCRIPTION The bark is grey-brown, smooth, and increasingly fissured with maturity (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Milletia grandis

FAMILY Fabaceae - Papilionaceae

AUTHORITY (E. Mey.) Skeels

SSP TAXON

SYNONYMS *M. caffra* Meisn.

ENGLISH/AFRIKAANS ironwood (E), umzimbeet (E), omsambeet (A), ysterhout (A)

ZULU umsimbithi, umsimbithwa

DESCRIPTION The bark is pale brown, or grey to dark grey, smooth or flaking (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION Since it is fast growing, it is suitable for woodlot cultivation (GELDENHUYS 2000).

ADDITIONAL INFORMATION

Mimusops caffra

FAMILY Sapotaceae

AUTHORITY E. Mey. ex A. DC.

SSP TAXON

SYNONYMS *M. oleifolia* N.E. Br., *M. woodii* Engl.

ENGLISH/AFRIKAANS coastal red milkwood (E), red milkwood (E), kusrooimelkhout (A), melkhout (A), moepel (A), rooimelkhout

ZULU amasethole, amasethole-abomvu, umhayihayi, umhlalankwazi, umkhayikhayi, umnole, umnole umagayi, umnweba wasolwande, umthunzi

DESCRIPTION Bark is dark grey, thin and wrinkled longitudinally; immature stems are densely pubescent with long, rust-coloured hairs (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Infusions are used as emetics (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION It was ranked among the most frequently demanded medicinal plant species in KwaZulu-Natal (MANDER 1998).

ADDITIONAL INFORMATION

Mimusops obovata

FAMILY Sapotaceae

AUTHORITY Sond.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS milkwood (E), red milkwood (E), bosmelkhout (A), moepel (A), rooimelkhout (A)

ZULU amasethole, amasethole-abomvu, umhlalankwazi

DESCRIPTION Bark is pale grey and rough (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Infusions are used as emetics (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Mundulea sericea

FAMILY Fabaceae - Papilionaceae

AUTHORITY (Willd.) A. Chev.

SSP TAXON

SYNONYMS *Cytisus sericeus* Willd., *Mundulea suberosa* (DC.) Benth., *Tephrosia suberosa* DC.

ENGLISH/AFRIKAANS cork bush (E), silver bush (E), kurkbos (A), olifantshout (A), visboontjie (A), visgif (A)

ZULU umamentabeni, umhlalantethe, umsindandlovu, usekwane

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES Rotenone, deguein, tephrosin, muduserone and undalone have been elucidated (VAN WYK & GERICKE 2000).

USE IN KWAZULU-NATAL It is used in emetics to treat cases of suspected poisoning (PALMER & PITMAN 1961).

USE IN SOUTHERN AFRICA In other regions of southern Africa, rootbark is used as a general prophylactic against disease, as an aphrodisiac, and to purify the spouse of a woman who has aborted or miscarried (HUTCHINGS *et al.* 1996). In Venda, the rootbark is employed to specify the gender of an unborn child (MABOGO 1990 cited in HUTCHINGS *et al.* 1996).

**CONSERVATION
ADDITIONAL INFORMATION**

Myrica serrata

FAMILY Myricaceae

AUTHORITY Lam.

SSP TAXON

SYNONYMS *Myrica conifera sensu* Hutch., Adamson, *non* Burm.f., *Myrica mossii* Burt Davy

ENGLISH/AFRIKAANS lance-leaf waxberry (E), wax berry (E), gammabos (A), smalblaarwasbessie (A), wasbessie (A)

ZULU ilethi, iyethi, umakuthula, umlulama (root)

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Decoctions of the rootbark are taken for colds, coughs and headaches (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Newtonia hildebrandtii

FAMILY Fabaceae - Mimosaceae

AUTHORITY (Vatke) Torre

SSP TAXON var. *hildebrandtii*

SYNONYMS

ENGLISH/AFRIKAANS Lebombo wattle (E), lowveld newtonia (E), Lebombowattel

ZULU udongolokamadilika, umfomothi, umfomoti

DESCRIPTION The bark is dark grey, cracked and longitudinally flaking (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Powdered bark is roasted then decocted with water and elephant dung; the drops are licked from the hand to drive away 'starts' while sleeping (PALMER & PITMAN 1961).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Nuxia floribunda

FAMILY Loganiaceae

AUTHORITY Benth.

SSP TAXON

SYNONYMS *Lachnopylis floribunda* (Benth.) C.A. Sm.

ENGLISH/AFRIKAANS forest elder (E), forest nuxia (E), wild elder (E), wild peach (E), bosvlier (A), vlier (A)

ZULU ingobese, isanywana, ithambo, umdlambandlaze, umgwaqu, umhlambandlazi, umkhobeza, umluluma, umsunu wembuzi, umsunubuzi, umuthi wokuzila

DESCRIPTION The bark is pale grey or grey-brown, smooth and powdery; branches are purple-toned and smooth or finely pubescent when immature, becoming fissured and flaking with raised leaf scars when mature (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The bark contains 5.71 % tannin (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL It is used as a strengthening medicine after the death of a kraal member (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION *N. floribunda* is resilient to bark removal; it may show rapid and complete regrowth after ringbarking (CUNNINGHAM 1991).

ADDITIONAL INFORMATION

Ochna holstii

FAMILY Ochnaceae

AUTHORITY Engl.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS common forest ochna (E), red ironwood (E), rooiysterhout

ZULU isibhanku

DESCRIPTION The bark is grey-brown and rough; branchlets have small lenticels (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Ochna natalitia

FAMILY Ochnaceae

AUTHORITY (Meisn.) Walp.

SSP TAXON

SYNONYMS *O. atropurpurea* sensu Harv. var. *natalitia* (Meisn.) Harv., *O. chilversii* Phill.

ENGLISH/AFRIKAANS Cape plane (E), coast boxwood (E), Natal plane (E), showy ochna (E), Transvaal boxwood (E), Natalrooihout (A), rooihout (A), ysterhout (A)

ZULU isendengulube, isithundu, mahlanganisa, sithundu, umadlozane, umahlanganiso, umbhovane, umbhovane-ongcinsi, umbovane, umbovu, umilamatsheni, umnandi, umshelele

DESCRIPTION The bark is grey brown or brown, finely fissured to rough or flaking to reveal red-toned underbark; branchlets are marked by lenticels and sometimes galls (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL The bark of *O. holstii* may be that known as 'umadlozane', used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION *O. natalitia* was ranked twelfth of the medicinal species most frequently demanded by consumers in KwaZulu-Natal (MANDER 1998).

ADDITIONAL INFORMATION

Ocotea bullata

FAMILY Lauraceae

AUTHORITY (Burch.) Baill.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS black stinkwood (E), laurel wood (E), stinkwood (E), stinkhout (A), swartstinkhout (A), swartstinkhoutboom (A), witstinkhout (A), witstinkhoutboom (A)

ZULU nukani, umnugani, umnukani, unukane, unukani

DESCRIPTION Bark is pale brown and attractive when young, becoming darker and scaled with maturity (COATES PALGRAVE 1977). The bark has a short-lived but strong odour when cut (HUTCHINGS *et al.*

1996), described by CUNNINGHAM (2001) as that of pig dung. Dried bark emits a strong fragrance resembling that of *Cinnamomum camphora* bark.

PHYTOCHEMICAL/PHYSICAL PROPERTIES It may contain up to 5.8 % tannins (WATT & BREYER-BRANDWIJK 1962). Several neolignans have been elucidated, notably ocobullenone (SEHLAPELO *et al.* 1993, DREWES *et al.* 1995 cited in VAN WYK *et al.* 1997). It also contains many volatile compounds, which may be monoterpenoids (VAN WYK *et al.* 1997). Phytochemical constituents are similar to the leaves, but less concentrated in the latter (ZSCHOCKE *et al.* 2000b, GELDENHUYS 2002a). Efficacy in treatment of headaches is attributed to anti-inflammatory activity (JÄGER *et al.* 1996), COX-1 inhibition and 5-lipoxygenase (ZSCHOCKE *et al.* 2000a). Volatiles are recognised as one of the main active principles responsible for anti-inflammatory activity (ZSCHOCKE *et al.* 2000a). The bark of *Cryptocarya* spp., used as substitutes for that of *O. bullata*, show superior activity to the latter in COX-1 and COX-2 inhibition (ZSCHOCKE & VAN STADEN 2000). GEORGE *et al.* (2001) cited ocobullenone from *O. bullata* as a phytomedicine with potential for commercial development in anti-inflammatory and emetic drugs. Genetic variation in populations from different regions of South Africa did not correlate to phytochemical variations observed in them (GELDENHUYS 2002a).

USE IN KWAZULU-NATAL It is powdered and taken as a snuff, or burned and the smoke inhaled, for headaches (WATT & BREYER-BRANDWIJK 1962). It is frequently used as a charm to cause competitors to become unpopular and bad smelling, due to the odour of freshly cut bark (HUTCHINGS *et al.* 1996). A powdered mixture of the bark of a tree known as 'unukani' - probably *O. bullata* - is used with the bark of a tree known as 'umahlabekufeni' and *Zingiber officinale* root is used to treat urinary tract infections. The preparation is administered to the bladder by blowing it through a narrow reed into the penis (HUTCHINGS *et al.* 1996). The barks of *Cinnamomum camphora* or *Cryptocarya* spp. are sometimes substituted for that of *O. bullata* (DREWES *et al.* 1997 cited in VAN WYK *et al.* 1997, GELDENHUYS 2002a).

USE IN SOUTHERN AFRICA It is an important traditional medicine in southern Africa. Its principal uses are against headache, urinary and nervous disorders, and diarrhoea in children (VAN WYK & GERICKE 2000).

CONSERVATION It is declining and vulnerable to extinction in KwaZulu-Natal, and is protected; global conservation status is lower risk (CUNNINGHAM 1988, SCOTT-SHAW 1999). It was among the 15 most scarce medicinal species nominated by both urban and rural herbalists (CUNNINGHAM 1988). MANDER (1998) reported that *O. bullata* was the second most frequently demanded medicinal plant species in KwaZulu-Natal. Similarly, WILLIAMS *et al.* (2000) reported that although perceived as scarce, it is among the most commonly traded bark products at medicinal plant markets on the Witwatersrand. In Mpumalanga Province, bark products are considered readily available and in high demand; bark is traded there for approximately R 500/kg (BOTHA *et al.* 2001) (*cf.* R 25 for a 50 kg-sized bag of bark at Isipingo medicinal plant market, KwaZulu-Natal in 1988, and R 5 in 1960 (CUNNINGHAM 1988)). In the 1980's, an unsuccessful programme was introduced to market bark harvested from trees felled for timber in the Knysna forests (CREIG 1984). *O. bullata* is currently the subject of a project to develop sustainable commercial bark and timber harvesting (GELDENHUYS 2002a). Damaged trees readily coppice but shoots are susceptible to browsing, and populations regenerate naturally in pioneer stands on forest margins (GELDENHUYS 2001, 2002a). Seed predation may significantly reduce germination in natural populations (CUNNINGHAM 1991). Genetic variation in populations from South Africa material for cultivation should be obtained locally rather than being imported from other populations (GELDENHUYS 2002a). The use of *O. bullata* leaves instead of bark may represent an effective management option in future (ZSCHOCKE *et al.* 2000b, ZSCHOCKE & VAN STADEN 2000, GELDENHUYS 2002a).

Ocotea kenyensis

FAMILY Lauraceae

AUTHORITY (Chiov.) Robyns

SSP TAXON

SYNONYMS *O. viridis* Kosterm.

ENGLISH/AFRIKAANS bastard stinkwood (E), basterstinkhout (A)

ZULU

DESCRIPTION Bark is brown, rough and longitudinally scaled (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION CUNNINGHAM (1988) classed it as vulnerable and declining in KwaZulu-Natal, and SCOTT-SHAW (1999) as vulnerable.

ADDITIONAL INFORMATION

Olea capensis

FAMILY Oleaceae

SSP TAXON ssp. *enervis* (Harv. ex C.H. Wr.) Verdoorn

SYNONYMS *O. enervis* Harv. ex C.H. Wr.

ENGLISH/AFRIKAANS bushveld ironwood (E), ironwood (E), bosveldysterhout (A), ysterhout (A)

ZULU igwanxi, isinhletshe, umangqengqe, umsishane, umsinjane

DESCRIPTION Bark is pale grey, becoming darker and vertically fissured with age; bark exudes a typical black gum on wounding (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Members of the Oleaceae contain sugar alcohols, saponins, tannins, coumarins and iridoid glycosides; alkaloids are rare (TREASE & EVANS 1983).

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA It is used extensively in the skin-lightener trade in the Eastern Cape Province of South Africa (LA COCK & BRIERS 1992). In Swaziland, 50 g bark is added to 1 litre warm water and a tablespoon taken three times daily to treat peptic ulcers (AMUSAN *et al.* 2002).

CONSERVATION MUIR (1990) reported that *O. capensis* ssp. *macrocarpa* showed coppice regeneration from 40 % of cut stems in Hlatikulu Forest Reserve, Maputaland.

ADDITIONAL INFORMATION

Olea europea

FAMILY Oleaceae

AUTHORITY L.

SSP TAXON ssp. *africana* (Mill.) P.S. Green

SYNONYMS *O. africana* Mill., *O. capensis* L. ssp. *enervis* (Harv. ex C.H. Wr.) Verdoorn

ENGLISH/AFRIKAANS wild olive (E), olienhout (A), olyfboom (A)

ZULU isadlulambazo, isi adlulambazo, umhlwathi, umnquma, umquma, umsityana

DESCRIPTION Bark is grey-brown, rough and flaking (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Members of the Oleaceae contain sugar alcohols, saponins, tannins, coumarins and iridoid glycosides; alkaloids are rare (TREASE & EVANS 1983). Lignans have been isolated from the bark of both subspecies of *O. europaea*, including africanol, 8-hydroxypinoresinol derivatives and olivil (VAN WYK *et al.* 1997).

USE IN KWAZULU-NATAL The bark is scraped and decocted for the treatment of bladder infections and headaches (ROBERTS 1983 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In some regions of South Africa, bark and wood chips from carvings are saved for kindling. Smoke from a fire made with the kindling is believed to clear the head and blood after excessive drinking (ROBERTS 1990). The Xhosa use decoctions, taken each morning, to treat urinary tract complaints (HUTCHINGS *et al.* 1996). Fresh bark is infused and taken to relieve colic (VAN WYK *et al.* 1997).

CONSERVATION

ADDITIONAL Taxonomy of the species is somewhat confused: *O. europaea* includes the subspecies *africana* (formerly *O. africana*) and *europaea* (VAN WYK *et al.* 1997).

Olea woodiana

FAMILY Oleaceae

AUTHORITY Knobl.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS forest olive (E), bosolienhout (A), olyfboom (A)

ZULU isadlulambazo, umhlwazimamba, umnqunyanya, umnqumo

DESCRIPTION Bark is pale grey and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Members of the Oleaceae contain sugar alcohols, saponins, tannins, coumarins and iridoid glycosides; alkaloids are rare (TREASE & EVANS 1983).

USE IN KWAZULU-NATAL It is used as an appetite stimulant and nerve tonic (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION It is vulnerable and declining in KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Ormocarpum trichocarpum

FAMILY Fabaceae - Papilionaceae

AUTHORITY (Taub.) Engl.

SSP TAXON

SYNONYMS *Diphaca trichocarpa* Taub., *Ormocarpum setosum* Burt Davy

ENGLISH/AFRIKAANS caterpillar pod (E), large caterpillar pod (E), rusperboontjie

ZULU isithibane

DESCRIPTION The bark is black-brown and rough (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used in emetics to treat cases of suspected poisoning (PALMER & PITMAN 1961).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Ozoroa engleri

FAMILY Anacardiaceae

AUTHORITY R. & A. Fernandes

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS white resin tree (E), witharpruisboom (A)

ZULU intovane

DESCRIPTION The bark is dark brown to grey, rough, and flaking in small square segments; watery latex is exuded (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It may be used in similar ways to *O. paniculosa* var. *paniculosa*, for dysentery and acute chest inflammation (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Ozoroa obovata

FAMILY Anacardiaceae

AUTHORITY (Oliv.) R. & A. Fernandes

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS broad-leaved resin tree (E), eastern raisin-berry (E), breëblaarharpuisboom (A)

ZULU isifice, isifici

DESCRIPTION The bark is grey, and rough in mature specimens (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It may be used in similar ways to *O. paniculosa* var. *paniculosa*, for dysentery and acute chest inflammation (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Ozoroa paniculosa

FAMILY Anacardiaceae

AUTHORITY (Son.) R. & A. Fernandes

SSP TAXON var. *paniculosa*

SYNONYMS *Rhus paniculosa*

ENGLISH/AFRIKAANS common resin tree (E), gewone harpuiboom (A)

ZULU isifika, isifice, isifeco sehlanzane

DESCRIPTION The bark is grey, and rough in mature specimens; bark on branches is brown-red (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains tannins, coagulating and colouring agents (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL Powdered bark is used for acute inflammatory conditions of the chest, and dysentery (WATT & BREYER-BRANDWIJK 1962). For adults it is preferably mixed with unspecified parts of *Berchemia zeyheri*, and administered orally or by enema (HUTCHINGS *et al.* 1996). Bark is used in ethnoveterinary medicine to treat abdominal ailments, but is poorly effective (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Ozoroa sphaerocarpa

FAMILY Anacardiaceae

AUTHORITY R. & A. Fernandes

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS bastard currant tree (E), currant resin tree (E), basterkorenteharpuiboom (A)

ZULU isifice

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It may be used in similar ways to *O. paniculosa* var. *paniculosa*, to treat chest ailments and dysentery (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In Swaziland, 50 g bark is mixed with the same quantity of *Athrixia phylicoides* DC. bark, added to 5 litres water, and the mixture used to wash wounds twice daily for 5 days (AMUSAN *et al.* 2002).

CONSERVATION

ADDITIONAL INFORMATION

Pappea capensis

FAMILY Sapindaceae

AUTHORITY Eckl. & Zeyh.

SSP TAXON

SYNONYMS *P. capensis* Eckl. & Zeyh. var. *radkloferi* (Schweinf. ex Radlk.) Schinz, *P. fulva* Conrath, *P. ugandensis* Bak.f., *Sapindus pappea* Sond. nom. illegit.

ENGLISH/AFRIKAANS bushveld cherry (E), indaba tree (E), jacket-plum (E), wild plum (E), bergpruim (A), doppruim (A), oliepit

ZULU indaba, liletha, liletsa, umgqogqqa, umkhokhwane, umqokhwane, umqhoqho, uvuma, uvuma-ebomvu (root)

DESCRIPTION Bark is pale grey to brown and smooth; immature branches are paler in colour (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA The Swahili use moistened rootbark for chest complaints; in Botswana it is used to treat venereal diseases, and in protective sprinkling charms (HEDBERG & STAUGARD 1989 cited in HUTCHINGS *et al.* 1996).

CONSERVATION In Mpumalanga Province, bark products of a species suspected to be *P. capensis* are in high demand but readily available, and are traded for between R 40 and R 91/kg (BOTH A *et al.* 2001).

ADDITIONAL INFORMATION

Peltophorum africanum

FAMILY Fabaceae - Caesalpinaceae

AUTHORITY Sond.

SSP TAXON

SYNONYMS *Brasilletia africana* (Sond.) Kuntze

ENGLISH/AFRIKAANS African wattle (E), wattle (E), weeping wattle (E), huilboom (A), kiaatboom (A)

ZULU iphambolebankomo, isikhaba-mkhombe, liphamblebankomo, umsehle, umthobo

DESCRIPTION Bark is brown, rough, and longitudinally fissured; bark on immature branches is grey and smooth (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains tannins (WATT & BREYER-BRANDWIJK 1962). The gum is reputedly toxic (PALMER & PITMAN 1961). Flavonoids and phenolics have been isolated in unspecified plant parts (GLASBY 1991).

USE IN KWAZULU-NATAL It is used to treat sterility and backache (POOLEY 1993).

USE IN SOUTHERN AFRICA It is chewed to relieve colic, or decocted to treat intestinal parasites (VENTER & VENTER 1996). Decoctions of the powdered stem- and rootbark are used to treat diarrhoea and dysentery (VENTER & VENTER 1996). In Zimbabwe, decoctions are taken as a general tonic (VAN WYK & GERICKE 2000). In Swaziland, 30 g each of the bark and roots are ground and added to a litre of warm water; a tablespoon is taken twice daily for two days to relieve stomach cramps (AMUSAN *et al.* 2002). A concoction made with 50 g bark boiled for 5 minutes in a litre of water, is taken in 250 ml doses three times daily to treat menorrhagia (AMSUAN *et al.* 2002).

CONSERVATION In Mpumalanga Province, the bark is readily available and consumer demands high; bark products are traded for approximately R 38/kg. In Northern Province, it is not in high demand (BOTH A *et al.* 2001). Coppice production may be manipulated by the cutting height at which trees are felled, and increased stump surface area (SHACKLETON 2000).

ADDITIONAL INFORMATION

Phyllanthus meyerianus

FAMILY Euphorbiaceae

AUTHORITY Müll. Arg.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS

ZULU ilethi

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Rootbark is used for coughs, colds and headaches (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Phyllanthus reticulatus

FAMILY Euphorbiaceae

AUTHORITY Poir.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS potato bush (E), roast potato plant (E), aartappelbos (A)

ZULU intaba yengwe, munyuswane, ubutswantimi, umchumelo, umtswathiba

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for bathing charms to conceal secrets from diviners (PALMER & PITMAN 1961). Mixtures of the rootbark and other ingredients are stirred and the froth licked from the surface without using the hands, to give clear and penetrating vision (HUTCHINGS *et al.* 1996). Rootbark infusions are used as emetics (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Pinus sp.

FAMILY Pinaceae

AUTHORITY L.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS pine tree (E)

ZULU abaphaphe-ababomvu, abaphaphe-abamhlope

DESCRIPTION

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983) for references.

USE IN KWAZULU-NATAL Two unidentified species are commonly used for their bark (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION A 50 kg-sized bag of bark cost R 25 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Pittosporum viridifloium

FAMILY Pittosporaceae

AUTHORITY Sims

SSP TAXON

SYNONYMS *P. abyssinicum* Delile var. *angolense* Oliv., *P. antunesii* Engl., *P. commutatum* Putterl., *P. floribundum* Wight & Arn., *P. kruegeri* Engl., *P. malosanum* Bak., *P. quartinianum* Desf., *P. sinense* Desf., *P. viridifolium* Sims spp. *malosanum* (Bak.) Cufod., *P. viridifolium* Sims ssp. *quartinianum* (Cofod.) Cufod., *P. viridifolium* Sims var. *angolense* (Oliv.) Cufod., *P. viridifolium* Sims var. *commutatum* (Putterl.) Möser., *P. vosseleri* Engl.

ENGLISH/AFRIKAANS cheesewood (E), boboekenhout (A), bosbeukenhout (A), kaarsuur (A), kasuur (A)

ZULU mposhe, umfusamvu, umkhwenkwe, umkwenkwe, umvusamu

DESCRIPTION The bark is pale brown or grey to grey-brown, marked by distinctive white lenticels and becomes rough and flaking with age (COATES PALGRAVE 1977, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It has *in vitro* anti-inflammatory properties (JÄGER *et al.* 1996) and exhibits antibacterial and antiamebic activity (McGAW *et al.* 2000). Like other members of the genus, it may contain terpenoids or their saponins, to which pharmacological activity may be attributed (VAN WYK *et al.* 1997). It has a bitter taste and strong smell described as resinous and liquorice-like (VENTER & VENTER 1996, VAN WYK *et al.* 1997).

USE IN KWAZULU-NATAL Pieces of bark measuring approximately 40 x 60 mm are pounded and steeped in approximately 600 ml boiling water. These decoctions are taken for febrile complaints, either orally with additional water to induce vomiting, or twice the volume for enemas (BRYANT 1966 cited in HUTCHINGS *et al.* 1996). Decoctions are also used as emetics against back pains, or enemas for stomach complaints (WATT & BREYER-BRANDWIJK 1962). Decoctions taken each morning are used to purify the blood (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used throughout southern Africa for stomach complaints, biliousness, pain and fever (VAN WYK & GERICKE 2000). It reportedly eases pain and has a calming effect (WATT & BREYER-BRANDWIJK 1962). The stembark is also used against chest complaints and malaria (IWU 1993). Roasted bark is used to treat dysentery (HUTCHINGS *et al.* 1996). Dried, powdered bark is taken in beer as an aphrodisiac (VENTER & VENTER 1996). In Swaziland, 30 g powdered bark is applied to the site of toothache twice daily until the pain disappears (AMUSAN *et al.* 2002).

CONSERVATION *P. viridifolium* is not yet highly endangered, but is heavily exploited for bark products in KwaZulu-Natal (Pers. comm. McKEAN 2001). In Mpumalanga Province, the bark is considered to be rare but consumer demands low; it is traded at between R 23 and R 333/kg (BOTH A *et al.* 2001). It germinates readily in plantations of the exotic *Acacia melanoxylon* R. Br. (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Pleurostyliia capensis

FAMILY Celastraceae

AUTHORITY (Turcz.) Loes.

SSP TAXON

SYNONYMS *Cathastrum capense* Tucz.

ENGLISH/AFRIKAANS coffee pear (A), mountain hard pear (E), bastersaffraanhout (A), berghardpeerhout (A), koffiepeer (A)

ZULU thunyulelelwa, urnngqangqa, umthelela, umthunyelelwa

DESCRIPTION Bark is grey-brown, fissured and readily flaking to reveal bright orange underbark (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA The Vhavenda use stembark and rootbark from male plants as charms for sorcery and benevolence (MABOGO 1990 cited in HUTCHINGS *et al.* 1996).

CONSERVATION CUNNINGHAM (1988) classed it as vulnerable and declining in KwaZulu-Natal. A 50 kg-sized bag of bark cost R 10 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal (CUNNINGHAM 1988). In Mpumalanga Province, it is not readily available and consumer demands are high; bark products are traded at between R 20 and R 59/kg (BOTHA *et al.* 2001).

ADDITIONAL INFORMATION

Podocarpus falcatus

FAMILY Podocarpaceae

AUTHORITY (Thunb.) R. Br. ex Mirb.

SSP TAXON

SYNONYMS *Podocarpus gracilior sensu* Burtt Davy, *non* Pilg.

ENGLISH/AFRIKAANS common yellow-wood (E), Outeniqua yellowwood (E), bastergeelhout (A), kalander (A), kolander (A), nietlander (E), nikolander (A), Outeniekwa geelhout (A)

ZULU umgeya, umhlehlane, umkhandangoma, umpume, umsonti

DESCRIPTION The bark is thin, grey-brown to dark brown, and smooth (COATES PALGRAVE 1977), sometimes peeling in curled, circular or rectangular flakes (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Bark is burned in the cattle kraal to prevent livestock from straying (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION Seedlings and saplings have been observed in the understory of exotic plantations in KwaZulu-Natal (GELDENHUYS 2000). It is fast growing and suited to establishment in woodlots (GELDENHUYS 2000). Coppice production is good (MUIR 1990).

ADDITIONAL INFORMATION

Podocarpus henkelii

FAMILY Podocarpaceae

AUTHORITY Stapf ex Dallim. & Jacks.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS East Griqualand yellow-wood (E), Henkel's yellowwood (E), Natal yellow-wood (E), bastergeelhout (A), Henkel-se-geelhout (A)

ZULU abanqongosi, abanqongqosi, abanqonqosi, umsonti

DESCRIPTION Bark is yellow-grey, brown or dark grey; in large specimens it is longitudinally fissured and flaking in long, narrow strips to expose the red-brown underbark (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains up to 6.1 % tannins (WATT & BREYER-BRANDWIJK 1962). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL It is widely used for unspecified purposes (CUNNINGHAM 1988). The bark of *P. henkelii* may be that known as 'abanqongqosi', used for love charms (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION *P. henkelii* is extremely sensitive to bark removal (CUNNINGHAM 1991).

ADDITIONAL INFORMATION

Podocarpus latifolius

FAMILY Podocarpaceae

AUTHORITY (Thunb.) R. Br. ex Mirb.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS real yellow-wood (E), true yellow-wood (E), yellow-wood (E), geelhout (A), opregte

geelhout (A)

ZULU umgeya, umkhoba, umsoni

DESCRIPTION The bark is yellow-brown, grey-brown to dark brown and flaking in narrow vertical flakes (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains up to 3.6 % tannins (WATT & BREYER-BRANDWIJK 1962). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL It is widely used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION *P. latifolius* germinates readily in plantations of the exotic *Acacia melanoxylon* R. Br. (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Protea caffra

FAMILY Proteaceae

AUTHORITY Meisn.

SSP TAXON ssp. *caffra*

SYNONYMS

ENGLISH/AFRIKAANS highveld protea (E), hoeveldsuikerbos (A), suikerbos (A)

ZULU isiqalaba, isiqalaba-sentaba, uhlinkhlane

DESCRIPTION The bark is black, rough and deeply fissured (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Warm infusions of rootbark are used to treat bleeding stomach ulcers, administered in 125 ml doses between meals (HUTCHINGS *et al.* 1996). They are also administered to calves with bloody diarrhoea (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In Venda, bark is used to treat dizziness (Mabogo 1990 cited in HUTCHINGS *et al.* 1996).

CONSERVATION

ADDITIONAL INFORMATION

Protea roupelliae

FAMILY Proteaceae

AUTHORITY Meisn.

SSP TAXON ssp. *roupelliae*

SYNONYMS

ENGLISH/AFRIKAANS silver protea (E), sugar bush (E), silwersuikerbos (A), suikerbos (A), waboom (A)

ZULU isiqalaba, isiqalaba-sentaba, uqhambathi

DESCRIPTION Bark is dark grey, rough, deeply fissured and cracked (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Protorhus longifolia

FAMILY Anacardiaceae

AUTHORITY (Bernh.) Engl.

SSP TAXON

SYNONYMS *Rhus longifolia* (Bernh.) Sond.

ENGLISH/AFRIKAANS red beech (E), harpuisboom (A), rooiblaar (A), rooiboekenhout (A)

ZULU inhlangothi, inhluthe, isifice, isifico, isifico-sehlathi, umhluthi, umhluthi wehlathi, umkhomizo, umuthi-ebomvu, unhlangothi

DESCRIPTION The bark is red-brown and smooth, becoming dark brown and rough; it exudes a sticky gum on wounding (COATES PALGRAVE 1977, VENTER & VENTER 1996). It has shown *in vitro* anti-inflammatory activity (JÄGER *et al.* 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is toxic (CUNNINGHAM 1988). It yields up to 18 % tanning material (WATT & BREYER-BRANDWIJK 1962), and 7 % tannins (VENTER & VENTER 1996).

USE IN KWAZULU-NATAL Powdered bark ('umsinzi') is injected into a patient suffering from hemiplegic paralysis, possibly caused by witchcraft, as it is said to be poisonous (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996, CUNNINGHAM 1988). Decoctions taken as emetics in 200 ml doses are used to relieve heartburn and bleeding in the stomach (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA Gum exuded from the bark is used as a depilatory (COATES PALGRAVE 1977).

CONSERVATION It is of indeterminate conservation status in KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Prunus africana

FAMILY Rosaceae

AUTHORITY (Hook. f.) Kalkm.

SSP TAXON

SYNONYMS *Pygeum africanum* Hook.f.

ENGLISH/AFRIKAANS African cherry (E), bitter almond (E), red stinkwood (E), bitteramandelboom (A), nuweamandelhout (A), rooistinkhout (A)

ZULU inkhokho, inyazangoma-elimnyama, inyazangoma-elimnyana, ngubozinyeweni, umdumezulu, umdumizula, umkhakhazi, umlalume

DESCRIPTION The bark is coarse and dark brown to black in colour (VAN WYK *et al.* 1997), with a distinctive scent of almonds (CUNNINGHAM 2001).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is reputedly toxic (PALMER & PITMAN 1961). The cyanogenic glycoside amygdalin has been identified (WATT & BREYER-BRANDWIJK 1962). Phytosterols such as β -sytosterol (free and conjugated forms), to which activity against prostatic adenoma may be attributed, have been isolated (BRUNETON 1995). It is patented in France for use against prostate cancer (GEORGE & VAN STADEN 2000), and patented hair tonics (HUTCHINGS *et al.* 1996). Activity against prostatic hypertrophy is attributed to a synergistic effect of phytosterols, pentacyclic triterpenes and ferulic esters in chloroform-extracted bark (ICRAF ONLINE 2000). The bark also contains campesterol, pentacyclic triterpenoid esters, linear aliphatic alcohols, and ferulic acid esters thereof (BRUNETON 1995). GEORGE *et al.* (2001) cited amygdalin and B-sitosterol from *P. africana* as phytochemicals with potential for commercial development, in drugs to treat benign prostate hypertrophy.

USE IN KWAZULU-NATAL Decoctions are used to treat intercostal pain (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In Europe, lipid and phytosterol extracts are commonly used in symptomatic therapy of prostatism caused by benign prostate hypertrophy; 100 mg is administered daily in six to eight week cycles (BRUNETON 1995). Pharmaceuticals containing *P. africana* bark extracts are also manufactured in the United States and several south American countries (CUNNINGHAM & CUNNINGHAM 2000).

CONSERVATION It is declining in KwaZulu-Natal (CUNNINGHAM 1988), and is conservation dependent and protected, with CITES II status (SCOTT-SHAW 1999). *P. africana* is heavily exploited for bark products in KwaZulu-Natal (Pers. comm. McKEAN 2001). The bark is one of the ten most commonly stocked products on the Witwatersrand (WILLIAMS 1996). *P. africana* bark is the largest internationally-traded volume of a medicinal plant species in Africa (CUNNINGHAM and CUNNINGHAM 2000). In Cameroon alone, bark harvests increased from 200 tons to 2 000 tons from 1980 to 2000 (ICRAF ONLINE 2000). Conservation-through-cultivation is being explored in some African countries (ICRAF ONLINE 2000). *P. africana* is

particularly resilient to harvesting pressure, and may exhibit regrowth after complete bark removal (CUNNINGHAM & MBENKUM 1993). Populations regenerate naturally in forest margins, and saplings have been observed in the understory of tall *Pinus* plantations in KwaZulu-Natal (GELDENHUYS 2002a). Since it is fast growing, GELDENHUYS (2000) recommended it for woodlot cultivation.

ADDITIONAL INFORMATION

Ptaeroxylon obliquum

FAMILY Ptaeroxycaceae

AUTHORITY (Thunb.) Radlk.

SSP TAXON

SYNONYMS *P. utile* Eckl. & Zeyh.

ENGLISH/AFRIKAANS sneezewood (E), nieshout (A), stinkhout (A)

ZULU umbhaqa, umfazi-othetha, umthathe

DESCRIPTION The bark is pale grey, almost white, becoming dark and fissured and sometimes flaking with age (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Powdered wood is a potent irritant and induces sneezing (VAN WYK *et al.* 1997). The wood contains many unusual chromones and other phenolics, such as ptaeroxylone and umtatin (DEAN & TAYLOR 1966 cited in VAN WYK *et al.* 1997). Compounds isolated from the bark include the acid saponin saptaeroxylon, volatile oil, pyrogallol tannins, resins, fats, and the flavone glycoside ptaeroxylon (HUTCHINGS *et al.* 1996). An alkaloid elucidated in the bark shows cardiac depressant activity (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL It is used for rheumatism and arthritis (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA The Xhosa use powdered bark as snuff for recreational purposes or to relieve headache (WATT & BREYER-BRANDWIJK 1962). Resin from the bark is applied to warts, and is used in dips to kill ticks on cattle (COATES PALGRAVE 1977). Infusions are used to relieve rheumatism and arthritis (PUJOL 1990 cited in VAN WYK *et al.* 1997).

CONSERVATION Populations regenerate naturally in forest margins, and saplings have been observed in the understory of tall *Pinus* plantations in KwaZulu-Natal (GELDENHUYS 2002a). It coppices well (75 % of cut stems) (MUIR 1990). Since it is fast growing, *P. obliquum* is suitable for woodlot cultivation (GELDENHUYS 2000).

ADDITIONAL INFORMATION

Pterocarpus angolensis

FAMILY Fabaceae - Papilionaceae

AUTHORITY DC.

SSP TAXON

SYNONYMS *P. bussei* Harms

ENGLISH/AFRIKAANS bloodwood (E), round-leaved kiaat (E), wild teak (E), dolf (A), dopperkiaat (A), grienhout (A), kiaat (A)

ZULU indlandlovu, umbilo, umvangazi

DESCRIPTION Bark is dark grey to brown, rough and longitudinally fissured; sticky red sap is exuded from wounds (COATES PALGRAVE 1977). Immature branches are velvet-textured due to pubescence (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA The red inner bark is used in an ointment in Namibia (PALMER & PITMAN 1961). Inner rootbark is sold in small bundles; it is powdered and mixed with animal fat and the ointment applied as a body lotion (COATES PALGRAVE 1977). Stembark is heated, mixed with figs [*Ficus* sp.], and the ointment applied to the breasts as a galactagogue (COATES PALGRAVE 1977). Bark may be boiled with fresh meat, and used to treat gonorrhoea (COATES PALGRAVE 1977). In Zimbabwe, infusions are

used to treat diarrhoea and menorrhagia; it is also used against schistosomiasis, blood in urine, backache, earache, ulcers and depressed fontanelles in infants (GELFAND *et al.* 1985). In South Africa, it is boiled and the resulting red liquid applied to skin lesions and ringworm infections, or a decoction taken to treat haemorrhoids (VENTER & VENTER 1996).

CONSERVATION

ADDITIONAL INFORMATION

Pterocelastrus echinatus

FAMILY Celastraceae

AUTHORITY N.E. Br.

SSP TAXON

SYNONYMS *P. galpinii* Loes., *P. rehmannii* Davidson, *P. variabilis sensu* Sim

ENGLISH/AFRIKAANS hedgehog pterocelastrus (E), hedgehog tree (E), white candlewood (E), white cherrywood (E), witkershout (A)

ZULU ingayi-elimbomvu, isihlulumanye, ugobandlovu, usahlulamanye

DESCRIPTION The bark is pale grey or brown, and thin; in immature specimens it scrapes away easily to reveal bright orange underbark (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL CUNNINGHAM (1988) noted its use, and PUJOL (1990 cited in HUTCHINGS *et al.* 1996) reported that *Pterocelastrus* spp., known as 'usahlulamanye', are taken as emetics for respiratory ailments, frequently with *Alepidia amatymbica* Eckl. & Zeyh.

USE IN SOUTHERN AFRICA In Swaziland, 50 g bark is ground with the same quantity of *Rapanea melanophloeos* (L.) Mez bark, added to a litre of warm water, and taken in tablespoon doses three times daily to treat general body aches (consumption of sugar and maize meal is contra-indicated) (AMUSAN *et al.* 2002).

CONSERVATION CUNNINGHAM (1988) classed it as declining in KwaZulu-Natal. The bark of an unidentified *Pterocelastrus* spp. is one of the most commonly stocked products on the Witwatersrand (Williams 1996). In Mpumalanga Province, bark of *Pterocelastrus* is in high demand and costs between R 15 and R 48/kg (BOTH A *et al.* 2001).

ADDITIONAL INFORMATION

Pterocelastrus rosastrus

FAMILY Celastraceae

AUTHORITY Walp.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS red candlewood (E), red cherrywood (E), white pear (E), kershout (A), kersiehout (A), rooikershout (A)

ZULU usahlulamanye

DESCRIPTION The bark is dark grey; bark of immature stems is red (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Bark yields 2 % tannin (COATES PALGRAVE 1977).

USE IN KWAZULU-NATAL It is an antidote to suspected sorcery (DOKE & VILIKAZI 1972 cited in HUTCHINGS *et al.* 1996). Powdered bark, mixed with other medicinal plants and the carcasses of fruit bats, is used to treat spinal disease (COATES PALGRAVE 1977). It is possibly used as an emetic for respiratory ailments, frequently with *Alepidia amatymbica* Eckl. & Zeyh. (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION It was classed as declining in KwaZulu-Natal (CUNNINGHAM 1988). The bark of an unidentified *Pterocelastrus* species is among the most commonly stocked products on the Witwatersrand (WILLIAMS 1996). In Mpumalanga Province, bark of *Pterocelastrus* is in high demand and costs between R 15 and R 48/kg (BOTH A *et al.* 2001).

ADDITIONAL INFORMATION

Pterocelastrus tricuspidatus

FAMILY Celastraceae

AUTHORITY (Lam.) Sond.

SSP TAXON

SYNONYMS *P. litoralis* Walp., *P. stenopterus* Walp., *P. tetrapterus* Walp.

ENGLISH/AFRIKAANS candlewood (E), cherrywood (E), kershout (A), kersiehout (A), rooikershout (A), witpeer (A)

ZULU usahlulamanye

DESCRIPTION The bark is dark brown, smooth and heavily lenticelled, but frequently fluted or buttressed (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Bark contains tannins (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL It is possibly used as an emetic for respiratory ailments, frequently with *Alepidia amatymbica* Eckl. & Zeyh. (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION CUNNINGHAM (1988) classed it as declining in KwaZulu-Natal. The bark of an unidentified *Pterocelastrus* species is among the most commonly stocked products on the Witwatersrand (WILLIAMS 1996). In Mpumalanga Province, bark of *Pterocelastrus* is in high demand and costs between R 15 and R 48/kg (BOTH A *et al.* 2001).

ADDITIONAL INFORMATION

Rapanea melanophloeos

FAMILY Myrsinaceae

AUTHORITY (L.) Mez

SSP TAXON

SYNONYMS *Myrsine melanophloeos* (L.) R. Br.

ENGLISH/AFRIKAANS Cape beech (E), rapanea (E), boekenhout (A), Kaapse boekenhout (A), rooiboekenhout (A), swartbas (A)

ZULU ikhubalwane, inhluthe, isicalabi, isiqalaba-sehlathi, maphipha, umaphipha, umaphipha-khubalo, umhluti-wentaba, uvukwabafile

DESCRIPTION The bark is grey, sometimes dotted with small diamond-shaped lenticels in raised areas, corky, and may be smooth or flaking (COATES PALGRAVE 1977, VAN WYK *et al.* 1997). Bark on immature branches is pink-grey, smooth with raised lenticels (VENTER & VENTER 1996).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Triterpenoid saponins, such as sakurasosaponin, are likely to occur in the bark as they are present in the leaves (OHTANI *et al.* 1993 cited in VAN WYK *et al.* 1997). Saponins may be responsible for the expectorant properties of the bark (VAN WYK *et al.* 1997). It contains 12-15 % tannin (VENTER & VENTER 1996). Rapanone was isolated in substantial amounts from specimens collected in the Kirkwood forests of KwaZulu-Natal, but the compound was absent from cultivated specimens (GEORGE *et al.* 2001).

USE IN KWAZULU-NATAL It is used as a sprinkling charm against lightning, and against acidity, muscular pain, fever, and to strengthen the heart (GERSTNER 1939, 1941 cited in HUTCHINGS *et al.* 1996, PUJOL 1990). Decoctions are used as expectorants, emetics and enemas (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA Decoctions of the ground bark are administered to treat haematemesis and stomach complaints; infusions are taken three times daily to remedy tearfulness (HUTCHINGS *et al.* 1996). Bark is dried and powdered, or fresh pieces chewed, to relieve sore throats and treat wounds; decoctions are used as expectorants or emetics (VENTER & VENTER 1996). It is used extensively in the skin-lightener trade in the Eastern Cape Province (LA COCK & BRIERS 1992). In Swaziland, 50 g bark is mixed with the same quantity of *Pterocelastrus echinatus* N. E. Br. bark, added to a litre of warm water, and taken in

tablespoon doses three times daily to treat general body aches (consumption of cane sugar or maize meal is contra-indicated) (AMUSAN *et al.* 2002).

CONSERVATION Although not highly endangered, *R. melanophloeos* is heavily exploited in KwaZulu-Natal (Pers. comm. McKEAN 2001), and the bark widely traded in South Africa (MANDER *et al.* 1997). It is commonly available at medicinal plant markets on the Witwatersrand (WILLIAMS *et al.* 2000). In Mpumalanga Province, bark products are traded at between R 33 and R 83/kg (BOTH A *et al.* 2001). In contrast, a 50 kg-sized bag of bark cost R 10 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal in 1988 (CUNNINGHAM 1988). Debarked trees do not recover easily, and coppice from debarked wounds and basal regions is poor (GELDENHUYS 2002a). Bark harvesting should be limited to narrow vertical strips to facilitate regeneration (GELDENHUYS 2002a). Populations regenerate naturally in forest margins and saplings have been observed in plantations of the exotic *Acacia melanoxylon* R. Br. (CUNNINGHAM 1988) and *Pinus* in KwaZulu-Natal (GELDENHUYS 2002a). It is fast growing and suited to woodlot cultivation (GELDENHUYS 2000).

ADDITIONAL INFORMATION

Rauvolfia caffra

FAMILY Apocynaceae

AUTHORITY Sond.

SSP TAXON

SYNONYMS *R. natalensis* Sond.

ENGLISH/AFRIKAANS quinine tree (E), kinaboom (A), koorsboom (A)

ZULU umhlambamasi, umhlambamanzi, umhlambhamanzi, umjele, umkhabamasi

DESCRIPTION Bark is grey to pale yellow-brown, rough and fissured but soft and corky; bark of immature specimens show characteristically wrinkled, glossy green bark with conspicuous leaf scars; milky latex is exuded (COATES PALGRAVE 1977, VENTER & VENTER 1996, VAN WYK *et al.* 1997). Bark texture varies greatly between specimens growing in coastal and upland regions (CUNNINGHAM 2001).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is bitter (HUTCHINGS *et al.* 1996) and is reported to induce severe abdominal pain and vomiting (WATT & BREYER-BRANDWIJK 1962). Cyanogenetic glycosides, leucoanthocyanins, saponins, tannins, coumarins, phenolic acids, cyclitols and triterpenoids are typical constituents of the Apocynaceae (TREASE & EVANS 1983). Many indole alkaloids occur in *R. caffra*, notably reserpine and ajmalicine (also referred to as raubasine), although this species is not a source of commercially used alkaloids (VAN WYK & GERICKE 2000). Reserpine is a well-known antihypertensive, antipsychotic and sedative, but evokes depression as a side effect. Ajmalicine is used in proprietary products that treat psychological and behavioural problems associated with senility, stroke and head injuries (VAN WYK & GERICKE 2000). Due to the presence of these alkaloids (possibly carboline alkaloids (GLASBY 1991)), the bark is toxic (WATT & BREYER-BRANDWIJK 1962). Immature rootbark may contain up to 3.05 % alkaloids (MADATI *et al.* 1977 cited in HUTCHINGS *et al.* 1996). GEORGE *et al.* (2001) cited *R. caffra* as a potentially commercial source of reserpine and ajmaline, for anti-hypertensive drugs used in therapy of cerebro-vascular and cranial traumas. See TREASE & EVANS (1983) and HUTCHINGS *et al.* (1996).

USE IN KWAZULU-NATAL Preparations are applied to measles, urticaria and other rashes, and bark is an ingredient in emetics to reduce fever (GERSTNER 1939 and BRYANT 1966 cited in HUTCHINGS *et al.* 1996). It is reported to kill maggots in infested wounds (WATT & BREYER-BRANDWIJK 1962). Decoctions containing the rootbark of *R. caffra*, *Zanthoxylum capense* (Thunb.) Harv., *Capparis tomentosa* Lam. and *Euclea natalensis* A. DC., roots or bulbs of *Polygala fruticosa* Berg., *Crinum* sp., *Cyrtanthus obliquus* Ait. and *Raphionacme* spp., are used to purify the blood, and to treat scrofula. The mixture is heated to induce perspiration, and the decoction taken mornings and evening thereafter (BRYANT 1966 cited in HUTCHINGS *et al.* 1996). Bark is chewed to relieve coughs, and is used against uterine complaints (PALMER & PITMAN 1961, PUJOL 1990 cited in HUTCHINGS *et al.* 1996). The bark of 'umhlabamanzi' - reportedly *R. caffra* - is used in medicines for abdominal pain, as a diuretic, and to ward off evil spirits (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA The Vhavenda use infusions to treat maggot-infested wounds (WATT & BREYER-BRANDWIJK 1962). Outside KwaZulu-Natal, decoctions are used to relieve abdominal and pelvic

ailments (HUTCHINGS *et al.* 1996). Decoctions are used as a tranquilliser for hysteria and insomnia, and against fever and malaria (VAN WYK *et al.* 1997).

CONSERVATION It is readily cultivated from seed and is fast-growing (COATES PALGRAVE 1977).

ADDITIONAL INFORMATION

Rhamnus prinoides

FAMILY Rhamnaceae

AUTHORITY L'Hér.

SSP TAXON

SYNONYMS *Celtis rhamnifolia* Presl. nom. illegit.

ENGLISH/AFRIKAANS dogwood (E), shiny leaf (E), blinkbaar (A)

ZULU ulenyenye, umgilindi, umhlinye, umnyenye, umyenye (root), unyenya, unyenye (root)

DESCRIPTION The bark is grey to brown, becoming darker with age, smooth, and marked by lenticels (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Members of the genus contain purgative quinones such as anthraquinones, anthranols and their glycosides (TREASE & EVANS 1983). See ABEGAZ *et al.* (1996).

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In the Transkei, decoctions are taken as emetics, and powdered bark as snuff for mental disorders (HUTCHINGS *et al.* 1996). In other parts of South Africa, rootbark decoctions are taken to purify the blood, and to treat pneumonia (VENTER & VENTER 1996).

CONSERVATION

ADDITIONAL INFORMATION

Rhus chirindensis

FAMILY Anacardiaceae

AUTHORITY Bak. f.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS red currant rhus (E), bloedhout (A), bosgarrie (A), bostaaios (A), ganna (A), taaibos (A)

ZULU ikhathabane, inhlokoshiyane-enkulu, inhlokoshiyane-enkhulu, inhlokoshiyane-yehlati, inyazangomaelimnyama, isibanda, uludwendwe lwengcuba, umdwendwe-lwengcuba, umdwendwelencuba, umhlabamvuti, umhlabamvubu, umyazangoma-ebomvu, umyazangoma-embomvu, umyazangoma-embomvu

DESCRIPTION Bark is smooth and brown (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES DUNCAN *et al.* (1999) reported that extracts showed angiotensin converting enzyme (ACE) inhibitors, indicating possible uses in treating hypertension. See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL It is used to strengthen the body, stimulate circulation, and relieve rheumatism (PUJOL 1990 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA Decoctions are used to treat mental illness in the Transkei (HUTCHINGS *et al.* 1996).

CONSERVATION GELDENHUYS (2001) considered it a key species damaged by bark harvesting in the Umzimkulu district of KwaZulu-Natal.

ADDITIONAL INFORMATION

Schotia brachypetala

FAMILY Fabaceae - Caesalpinaceae

AUTHORITY Sond.

SSP TAXON

SYNONYMS *Schotia brachypetala* Sond. var. *pubescens* Burt Davy, *Schotia rogersii* Burt Davy, *Schotia semireducta* Merxm.

ENGLISH/AFRIKAANS Boer-bean (E), tree fuschia (E), weeping boer-bean (E), weeping schotia (E), boerboon (A) Hottentotsboerboon (A), huilboerboon (A)

ZULU ihlusi, ihluze, umgxamu, umxano, uvovovo

DESCRIPTION The bark is rough and grey, grey-brown to red-brown (COATES PALGRAVE 1977, VENTER & VENTER 1996, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Pharmacological efficacy may be attributable to tannins (BRUNETON 1995). Decoctions are reported to cause vomiting (HULME 1954 cited in HUTCHINGS *et al.* 1996). The heartwood contains polyhydroxystilbenes (DREWES & FLETCHER 1974 cited in VAN WYK *et al.* 1997). Phenolics and stilbenes have been elucidated in unspecified plant parts (GLASBY 1991).

USE IN KWAZULU-NATAL Infusions are taken as emetics for acne (HULME 1954 cited in HUTCHINGS *et al.* 1996), and decoctions for heartburn and after excessive drinking (WATT & BREYER-BRANDWIJK 1962). It is used to strengthen the body, and as a face steamer (PUJOL 1990 cited in HUTCHINGS *et al.* 1996). It is an ingredient of red bark mixtures known as 'ikhubalo', used to ward off evil and cure unspecified ailments (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In regions of South Africa, decoctions are used to relieve heartburn and hangover (COATES PALGRAVE 1977). It is used in Venda to treat nervous and cardiac conditions (NETSHIUNGANI 1981 cited in VAN WYK *et al.* 1997). It is used in washes applied to swellings (HUTCHINGS *et al.* 1996). In Swaziland, 50 g bark is ground with the same quantity bark of *Sclerocarya birrea* (A. Rich.) Hochst, added to 5 litres warm water, and taken in 250 ml doses as an emetic; a 5 litre mixture prepared similarly is boiled for steaming to treat painful shoulders as necessary (AMUSAN *et al.* 2002).

CONSERVATION CUNNINGHAM (1988) reported a 50 kg-sized bag of bark cost R 10 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal. MANDER (1998) ranked it among the thirteen most frequently demanded medicinal species in KwaZulu-Natal.

ADDITIONAL INFORMATION

Schotia capitata

FAMILY Fabaceae - Caesalpinaceae

AUTHORITY Bolle

SSP TAXON

SYNONYMS *S. tamarindifolia* Afzel. ex Sims var. *forbesiana* Baill., *S. transvaalensis* Rolfe, *Theodora capitata* (Bolle) Taub.

ENGLISH/AFRIKAANS dwarf boer-bean (E), dwarf schotia (E), huilboerboon (A), kleinboerboon (A)

ZULU isincasha, isivovovane-esincane, isivovwane, umgxamu, uvovovwana

DESCRIPTION The bark is grey and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION CUNNINGHAM (1988) reported a 50 kg-sized bag of bark cost R 10 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal. MANDER (1998) ranked it among the thirteen most frequently demanded medicinal species in KwaZulu-Natal.

ADDITIONAL INFORMATION

Sclerocarya birrea

FAMILY Anacardiaceae

AUTHORITY (A. Rich.) Hochst.

SSP TAXON ssp. *caffra* (Sond.) Kokwaro

SYNONYMS

ENGLISH/AFRIKAANS cider tree (E), marula (E), maroela (A)

ZULU umganu

DESCRIPTION The bark is grey, rough and flaking, with a mottled appearance due to contrasting grey and pale brown patches; immature branches are grey and smooth with conspicuous leaf scars (VENTER & VENTER 1996, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Extracts do not show in vitro anti-malarial effects (WATT & BREYER-BRANDWIJK 1962). Antidiarrhoeal properties are attributed to procyanidins (GALVEZ *et al.* 1993 cited in VAN WYK & GERICKE 2000). High tannin content (20.5 %) and alkaloids (VENTER & VENTER 1996) may contribute to antidiarrhoeal activity. Procyanidins isolated from the bark inhibit peristalsis in guinea-pig colon, and have anti-diarrhoeal effects on guinea-pig ileum and in mice (GALVEZ *et al.* 1991, 1993 cited in HUTCHINGS *et al.* 1996). Stembark extracts have shown antimicrobial activity (HUSSEIN & DEENI 1991 cited in HUTCHINGS *et al.* 1996). McGAW *et al.* (2000) reported antiamoebic and antibacterial activity of polar extracts. Inner bark has antihistaminic activity against insect bites and burns caused by caterpillar hairs (VENTER & VENTER 1996).

USE IN KWAZULU-NATAL Decoctions are administered as enemas to treat malaria and diarrhoea, or taken as a tea twice daily to strengthen the heart, or as blood-cleansing emetics before marriage (GERSTNER 1939 cited in HUTCHINGS *et al.* 1996, PUJOL 1990). Decoctions are used as a wash for patients with gangrenous rectitis, and are also used by the traditional healer before consulting the patient (BRYANT 1966 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In Venda, powdered bark is administered to pregnant women to influence the sex of the expected child (bark taken from the male or female tree results in the birth of a child of the same sex) (WATT & BREYER-BRANDWIJK 1962). In other regions of South Africa, tea made with the bark (250 ml bark pieces boiled in 3 litres water for three hours, cooled, strained and bottled), is administered in small doses in treatment of diarrhoea, dysentery, malaria, gonorrhoea and abdominal upsets (ROBERTS 1990). Dosage for diarrhoea and dysentery is 300ml (HUTCHINGS *et al.* 1996). It is also used as a prophylactic and in therapy of malaria; bark is gathered in spring prior to budding, preserved in brandy and taken in small doses three to six times daily (ROBERTS 1990). Alternatively, the bark is powdered and 5 ml doses taken in water twice daily (ROBERTS 1990). Although medical tests have shown this to be an ineffective medicine, it is highly reputable (ROBERTS 1990). Among its many purposes are popular remedies for diabetes, fever and malaria. Inner bark is boiled and applied as a poultice to ulcers, smallpox and skin eruptions (ROBERTS 1990). In Venda, it is used to reduce fever, treat stomach complaints, headaches, ulcers, toothache, backache and infertility (MABOGO 1990 cited in HUTCHINGS *et al.* 1996). In Swaziland, 50 g bark is ground with the same quantity bark of *Schotia brachypetala* Sond., added to 5 litres warm water, and taken in 250 ml doses as an emetic; a 5 litre mixture prepared similarly is boiled for steaming to treat painful shoulders as necessary (AMUSAN *et al.* 2002).

CONSERVATION MANDER (1998) ranked it tenth among the medicinal species most frequently demanded by consumers in KwaZulu-Natal.

ADDITIONAL INFORMATION

Scolopia mundii

FAMILY Flacourtiaceae

AUTHORITY (Eckl. & Zeyh.) Warb.

SSP TAXON

SYNONYMS *Eruidaphus mundii* Eckl. & Zeyh., *Phoberos mundii* (Eckl. & Zeyh.) Harv.

ENGLISH/AFRIKAANS mountain saffron (E), red pear (E), bergsaffraan (A), klipdoring (A), rooipeer (A)

ZULU idungamuzi-lehlati, ihambahlala, ingqumuza, uloyiphela, umdwendwelencuba

DESCRIPTION Bark is grey to brown, smooth or flaking (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It may be responsible for fatal and near fatal poisoning cases, in which patients exhibited abdominal pain, vomiting and unconsciousness (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL It is used for unspecified purposes (CUNNINGHAM 1988). 'Udwendewe iwengcuba' refers to herbalists' medicine for heart complaints (DOKE & VILAKAZI 1972 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Securinega virosa

FAMILY Euphorbiaceae

AUTHORITY (Roxb. ex Willd.) Pax & K. Hoffm.

SSP TAXON

SYNONYMS *Flueggea microcarpa* Blume, *F. virosa*

ENGLISH/AFRIKAANS snowberry tree (E), white-berry bush (E), witbessiebos (A)

ZULU isibangamhlota sehlali, umyaweyane

DESCRIPTION Bark is red-brown to brown (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains tannin, and is therefore an effective treatment for diarrhoea and pneumonia (COATES PALGRAVE 1977). Alkaloids have been elucidated in unspecified plant parts (GLASBY 1991).

USE IN KWAZULU-NATAL It used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used in medicines for diarrhoea, pneumonia and malaria (HUTCHINGS *et al.* 1996).

CONSERVATION

ADDITIONAL INFORMATION

Sideroxylon inerme

FAMILY Sapotaceae

AUTHORITY L.

SSP TAXON *ssp. inerme*

SYNONYMS

ENGLISH/AFRIKAANS milkweed (E), white milkwood (E), witmelkhout (A)

ZULU amasethole, amasethole-amhlope, umakwela finqane, umaphipha, umbhobe, umbobe, umhlahle

DESCRIPTION Bark is brown, becoming almost black, and thick, with maturity; immature branches are covered in soft grey to rust-coloured hairs (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Latex exuded from the bark is acrid (WATT & BREYER-BRANDWIJK 1962). Compounds elucidated in the bark include cinnamic acid, kaemperfol and leucanthocyanins (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL Rootbark is cooked and approximately 250 ml administered as an enema to induce excessive perspiration (GERSTNER 1941 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used in Xhosa ethnoveterinary medicine to treat gallsickness in livestock (WATT & BREYER-BRANDWIJK 1962). It is used extensively in the skin-lightener trade in the Eastern Cape Province of South Africa (LA COCK & BRIERS 1992).

CONSERVATION It was ranked among the most frequently demanded medicinal plant species in KwaZulu-Natal (MANDER 1998).

ADDITIONAL INFORMATION

Spirostachys africana

FAMILY Euphorbiaceae

AUTHORITY Sond.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS African sandalwood (E), Cape sandalwood (E), headache tree (E), jumping-bean tree (E), tamboti (E), gifboom (A), melkhout (A), sandalbeen (A), tambotie (A), tambotiebeen (A)

ZULU injuqu, ubanda, umthombothi

DESCRIPTION Bark is dark grey to black, rough and flaking in rectangular chunks (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains exoecarin (WATT & BREYER-BRANDWIJK 1962). Milky latex secreted by the plant is extremely toxic; contact causes acute irritation of the skin, pain and damage to the eyes (COATES PALGRAVE 1977). All plant parts are toxic and administration may result in fatality (VAN WYK & GERICKE 2000). One drop of latex results in purging and vomiting; cow's milk is reportedly an effective antidote to irritations caused by the latex and sap (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL Infusions are used in small dosages for stomach ulcers and as eye washes (PALMER & PITMAN 1961). Decoctions of powdered bark are taken for stomach ulcers and acute mielie meal or porridge oats to make a thin gruel, and 250 ml taken three times daily on an empty stomach, with no other liquid drunk for a while thereafter (HUTCHINGS *et al.* 1996). Dried bark is used in embrocations for rashes in infants (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA In southern Africa, weak bark infusions may be used as emetics or purgatives, but all plant parts are toxic and may result in damage to internal organs, or fatality (VENTER & VENTER 1996, VAN WYK & GERICKE 2000). Stembark or rootbark infusions are used to treat renal ailments and to purify the blood (HUTCHINGS *et al.* 1996). In Swaziland, 50 g bark is ground and added to 5 litres warm water and the decoction taken twice daily for three days to relieve constipation (AMUSAN *et al.* 2002). Alternatively, 50 g bark is ground with the same quantity of *Trichilia emetica* Vahl. bark, and boiled for 10 minutes in 5 litres water to treat constipation (AMUSAN *et al.* 2002).

CONSERVATION In Mpumalanga Province, the bark is in high demand but readily available; it is sold for approximately R 25/kg (BOTHA *et al.* 2001).

ADDITIONAL INFORMATION

Strychnos decussata

FAMILY Loganiaceae

AUTHORITY (Pappe) Gilg

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS Cape teak (E), Chaka's wood (E), Panda's walking stick tree (E), Kaapse kiaat (A), kiaat (A)

ZULU inama, umgangele, umhlamahlala, umkhangala, umkhombazulu, umlahlankosi, umpathankosi, umpathankosi-omhlope, umpathawenkosi

DESCRIPTION The bark is dark grey, smooth but with prominent light brown lenticels; branchlets also have conspicuous lenticels and a waxy layer that splits longitudinally and peels (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is reputedly toxic, especially when green (COATES PALGRAVE 1977). Members of the Loganiaceae are rich in alkaloids of the indole and oxindole groups, and contain the aucubin glycoside loganin, and iridoids (TREASE & EVANS 1983). Alkaloids elucidated from the stembark of *S. decussata* exhibit muscle relaxant properties; bark extracts have similar effects (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL Rootbark is scraped and powdered, and a pinch taken as snuff, or taken in water for stomach complaints and cramps (PALMER & PITMAN 1961).

USE IN SOUTHERN AFRICA

CONSERVATION
ADDITIONAL INFORMATION

Strychnos henningsii

FAMILY Loganiaceae

AUTHORITY Gilg

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS coffee bean strychnos (E), coffee hard pear (E), Natal teak (E), red bitterberry (E), hardepeer (A), hardepeerhout (A), rooibitterbessie (A)

ZULU manono, umanana, umdunye, umnono, umqalothi, umqaloti

DESCRIPTION The bark is pale grey and smooth in immature trees, and becomes dark brown, flaky and mottled by pale grey patches in mature specimens; branchlets have a waxy layer, which splits longitudinally and peels (COATES PALGRAVE 1977, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The bark induces similar responses to strychnine in rabbits; MLD is 20-50 g/kg (WATT & BREYER-BRANDWIJK 1962). Members of the Loganiaceae are rich in alkaloids of the indole and oxindole groups, and contain the aucubin glycoside loganin, and iridoids (TREASE & EVANS 1983). Alkaloid fractions induced symptoms similar to strychnine poisoning in mice (OGETO *et al.* 1984 cited in HUTCHINGS *et al.* 1996). Alkaloids are concentrated in the bark, and many have been isolated (HUTCHINGS *et al.* 1996). Stembark alkaloids have shown convulsive, hypotensive and cardiac depressant activity, due to their effect on the Central Nervous System (CNS), and anti-cancer potential (CUNNINGHAM 1988, HUTCHINGS *et al.* 1996). Extracts of a mixture of stem- and rootbark showed no muscle-relaxant or convulsive activity (HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL Powdered bark is taken in 10 ml doses in the same volume of cold water for nausea (WATT & BREYER-BRANDWIJK 1962), or chewed for stomach complaints (DOKE & VILAKAZI 1972 cited in HUTCHINGS *et al.* 1996). Decoctions also containing the roots of *Turrea floribunda* Hochst. are used to relieve the pain associated with rheumatic fever (HUTCHINGS *et al.* 1996). The bark of umqalothi - possibly *S. henningsii* - is used in the treatment of dysmenorrhoea (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used to treat schistosomiasis (PUJOL 1990). In Pondoland, it is taken as a bitter appetiser (HUTCHINGS *et al.* 1996). The barks of several *Strychnos* spp. are used for snakebite antidotes throughout southern Africa (VAN WYK *et al.* 1997).

CONSERVATION It coppices well (75 % of cut stems) (MUIR 1990).

ADDITIONAL INFORMATION

Synadenium cupulare

FAMILY Euphorbiaceae

AUTHORITY (Boiss.) L.C. Wheeler

SSP TAXON

SYNONYMS *S. arborescens* Boiss.

ENGLISH/AFRIKAANS deadman's tree (E), dooiemansboom (A), gifboom (A)

ZULU umbulele, umdlebe, umdlebe-omnacane, umdletshane, umzilanyone

DESCRIPTION The bark is green to grey-green and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES *S. cupulare* is extremely toxic, and the latex irritant (Bryant 1909 cited in CUNNINGHAM 1988).

USE IN KWAZULU-NATAL The bark is employed in a potent sorcery charm (WATT 1967 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Syzigium cordatum

FAMILY Myrtaceae

AUTHORITY Hochst.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS water berry (E), waterbessie (A)

ZULU umdoni

DESCRIPTION The bark is rough and dark brown in colour (VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The bark and wood contain proanthocyanidins, pentacyclic triterpenoids, ellagic acid, gallic acid and derivatives thereof (CANDY *et al.* 1968 cited in VAN WYK *et al.* 1997). Phenolics may be responsible for antidiarrhoeal properties (BRUNETON 1995).

USE IN KWAZULU-NATAL It used for unspecified purposes (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA The Vhavenda use it to treat headaches, amenorrhoea and wounds (MABUGO 1990 cited in HUTCHINGS *et al.* 1996). It is widely used elsewhere in southern Africa to treat stomach complaints, diarrhoea, and as an emetic (VAN WYK & GERICKE 2000). It is also used to treat respiratory ailments such as tuberculosis (WATT & BREYER-BRANDWIJK 1962, VAN WYK *et al.* 1997).

CONSERVATION

ADDITIONAL INFORMATION

Syzigium gerrardii

FAMILY Myrtaceae

AUTHORITY (Harv. ex. Hook.f.) Burt Davy

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS forest water berry (E), forest waterwood (E), wild myrtle (E), boswaterhout (A), vaderlandswilgerboom (A)

ZULU isifecane, umdlumuthwa, umdoni, umdoni-wehlathi, umduywana

DESCRIPTION Bark varies from pale grey and smooth to grey-brown or dark grey and rough (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The bark contains up to 16.7 % tannins (WATT & BREYER-BRANDWIJK 1962).

USE IN KWAZULU-NATAL Infusions are used to treat tuberculosis and other chest ailments (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA Infusions are used to remedy chest complaints and are said to relieve chest pain and coughs (WATT & BREYER-BRANDWIJK 1962, COATES PALGRAVE 1977).

CONSERVATION

ADDITIONAL INFORMATION

Tabernaemontana ventricosa

FAMILY Apocynaceae

AUTHORITY Hochst. ex A. DC.

SSP TAXON

SYNONYMS *Conopharyngia ventricosa* (Hochst. ex DC.) Stapf.

ENGLISH/AFRIKAANS forest toad tree (E), small-fruited toad tree (E), toad tree (E), bospaddaboom (A), paddaboom (A)

ZULU umkhadlu, umkhalwana

DESCRIPTION The bark is grey (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Cyanogenetic glycosides, leucoanthocyanins, saponins, tannins, coumarins, phenolic acids, cyclitols and triterpenoids are typical constituents of the Apocynaceae

(TREASE & EVANS 1983). Alkaloids isolated from the stem bark include the major compounds 10-hydroxyheptanamine and akuammicine (SCHRIPSEMA *et al.* 1986 cited in HUTCHINGS *et al.* 1996). Extracts do not show antimalarial properties *in vitro* (WATT & BREYER-BRANDWIJK

USE IN KWAZULU-NATAL It is used to treat fever (POOLEY 1993).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Tecomaria capensis

FAMILY Bignoniaceae

AUTHORITY (Thunb.) Spach

SSP TAXON *ssp. capensis*

SYNONYMS *Bignonia capensis* Thunb.

ENGLISH/AFRIKAANS Cape honeysuckle (E), tecoma (E), Kaapse kamperfolie (A), Kaapse kanferfolie (A), trompetters (A)

ZULU lungana, uchahacha, umunyane

DESCRIPTION The bark is pale brown and heavily marked by lenticels (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES McGAW *et al.* (2000) reported antibacterial activity of polar extracts against *Staphylococcus aureus*.

USE IN KWAZULU-NATAL Dried bark is powdered and infused for medicines against fever, pain, sleeplessness, chest ailments, diarrhoea, dysentery and stomachache (ROBERTS 1990).

USE IN SOUTHERN AFRICA In southern Africa, powdered bark is used to treat influenza and pneumonia (HUTCHINGS *et al.* 1996, VENTER & VENTER 1996), or rubbed on bleeding gums to promote blood coagulation (VAN WYK & GERICKE 2000). The Sotho use powdered bark to treat abdominal complaints, fever and pneumonia (WATT & BREYER-BRANDWIJK 1962).

CONSERVATION

ADDITIONAL INFORMATION

Trema orientalis

FAMILY Ulmaceae

AUTHORITY (L.) Blume

SSP TAXON

SYNONYMS *T. guineensis* (Schumach. & Thonn.) Filcaho

ENGLISH/AFRIKAANS pigeonwood (E), hophout (A)

ZULU ifamu, iphubane, isakasaka, isikhwelamfene, sakasaka, ubathini, umbhangabhanga, umbokhangabokhanga, umcebekhazana, umdindwa, umsekeseke, umvangazi

DESCRIPTION Bark is pale grey and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Several compounds, including tannins, have been isolated (HUTCHINGS *et al.* 1996). Handling may cause eczema (HUTCHINGS *et al.* 1996). McGAW *et al.* (2000) reported minor anthelmintic activity of extracts.

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Trichilia dregeana

FAMILY Meliaceae

AUTHORITY Sond.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS forest mahogany (E), Natal forest mahogany (E), bosrooiesenhout (A)

ZULU ixolo, umathunzini, umkhula, umkhuhlu

DESCRIPTION The bark is grey and smooth (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It is extremely toxic (BRYANT 1909 cited in CUNNINGHAM 1988). Many so-called trichilin liminoids have been isolated from the seed oil and rootbark (NAKATANI *et al.* 1981 cited in VAN WYK *et al.* 1997). JÄGER *et al.* (1996) reported in vitro anti-inflammatory activity.

USE IN KWAZULU-NATAL It is used for unspecified purposes (HUTCHINGS *et al.* 1996). The bark of an unidentified *Trichilia* is used to decrease milk production in heavily lactating women; powdered bark is rubbed into incisions made on the breasts (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA It is used for stomach and intestinal complaints, and as a purgative administered by enema, in unspecified regions of southern Africa (BRYANT 1909 cited in CUNNINGHAM 1988). The Xhosa use decoctions of powdered bark to treat backache symptomatic of renal disorders (HUTCHINGS *et al.* 1996). Medicine is prepared with 5 ml powdered bark in 250 ml cow's milk, cooled and strained, and 125 ml administered by enema in the morning (oral administration may be toxic); excessive purging as a result of the treatment may be countered by drinking cow's milk (HUTCHINGS *et al.* 1996). Bark decoctions are similarly used in Venda, and to treat stomach complaints and purify the blood (MABOGO 1990 cited in HUTCHINGS *et al.* 1996). In Zimbabwe, bark is used as a purgative and abortifacient (GELFAND *et al.* 1985).

CONSERVATION A 50 kg-sized bag of an unidentified *Trichilia* bark cost R 10 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Trichilia emetica

FAMILY Meliaceae

AUTHORITY Vahl

SSP TAXON

SYNONYMS *T. roka* Chiov. nom. illegit.

ENGLISH/AFRIKAANS Cape mahogany (E), Natal mahogany (E), red ash (E), thunder tree (E), basteresshout (A), basteressenhout (A), rooiesenhout (A)

ZULU ixolo, umathunzini, umkhuhla, umkhuhlu, umkhuhlwa

DESCRIPTION The bark is smooth to slightly rough, dark grey to grey-brown (COATES PALGRAVE 1977, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES The bark is extremely toxic (BRYANT 1909 cited in CUNNINGHAM 1988, WATT & BREYER-BRANDWIJK 1962). It contains resins and tannins; a bitter principle has been elucidated in the rootbark (WATT & BREYER-BRANDWIJK 1962). Many so-called trichilin liminoides have been isolated from the rootbark (NAKATANI *et al.* 1981 cited in VAN WYK *et al.* 1997). Enemas made with all plant parts are said to result in sweating and vomiting, and may be fatal, yet bark is not toxic to guinea pigs (HUTCHINGS *et al.* 1996). Purgative effects of the bark may be attributable to resin content (JAMIESON 1916 cited in HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL Bark is powdered and decocted in 500 ml hot water and administered as enemas for stomach or intestine complaints (BRYANT 1966 cited in HUTCHINGS *et al.* 1996). Infusions are used for lumbago, rectal ulceration in children, and dysentery (WATT & BREYER-BRANDWIJK 1962). The bark of an unidentified *Trichilia* is used to decrease milk production in heavily lactating women; powdered bark is rubbed into incisions made on the breasts (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA In Venda, decoctions are administered as enemas to treat renal ailments and intestinal parasites; enemas are further used to cleanse the digestive tract and blood (HUTCHINGS *et al.* 1996). In Zimbabwe, it is used as an abortifacient (GELFAND *et al.* 1985). In Swaziland, 50 g bark is ground with the same quantity of *Spirostachys africana* Sond. bark, and boiled for 10 minutes in 5 litres water to treat constipation (AMUSAN *et al.* 2002). To treat backache, a single dose of 30 g bark boiled in a litre of water for one hour, is administered by enema (AMUSAN *et al.* 2002).

CONSERVATION A 50 kg-sized bag of an unidentified *Trichilia* bark cost R 10 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Turraea floribunda

FAMILY Meliaceae

AUTHORITY Hochst.

SSP TAXON

SYNONYMS *T. heterophylla sensu* Sond.

ENGLISH/AFRIKAANS wild honeysuckle tree (E), wildekamperfoelieboom (A)

ZULU ubhugulo, ululame, umadlozana, umadlozane, umhulana, umlulama, umlulama-omncane, umuthi wokuzila, umvuma, uvuma (root)

DESCRIPTION Bark is variable shades of brown and rough; immature branchlets are velvet-textured and red- to purple-brown (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES High dosages are reputedly toxic (COATES PALGRAVE 1977). Three liminoids have been isolated (MULHOLLAND 1996).

USE IN KWAZULU-NATAL It is taken in emetic medicines to prevent fearful dreams that are symptomatic of cardiac weakness (BRYANT 1966 cited in HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA It is used to treat rheumatism, dropsy and heart disease, and taken by diviners to induce a trance (COATES PALGRAVE 1977).

CONSERVATION It was ranked among the most frequently demanded medicinal species in KwaZulu-Natal (MANDER 1998). It may regenerate by coppice (MUIR (1990) reported 53 % of cut stems produced coppice shoots in the Hlatikulu Forest Reserve, Maputaland.

ADDITIONAL INFORMATION

Turraea obtusifolia

FAMILY Meliaceae

AUTHORITY Hochst.

SSP TAXON

SYNONYMS *T. oblancifolia* Brem., *T. obtusifolia* Hochst. var. *microphylla* C. DC.

ENGLISH/AFRIKAANS lesser honeysuckle tree (E), small honeysuckle tree (E), wild honeysuckle (E), kleinkamperfoelieboom (A)

ZULU amazulu, ikhambi-lomsinga (root), ikunzi (root), ikunzi ebomvana, inkunzi (root), inswazi, umhlatholana (leaves/stem), umhlatolana (leaves/stem), uswazi (leaves, stem, root)

DESCRIPTION Bark is grey-brown, smooth and marked by lenticels; young shoots are finely pubescent (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL An infusion of root- or stembark, prepared with a handful of bark and approximately 600 ml hot water, is diluted and administered by enema to treat stomach and intestinal complaints. Thereafter more infusion is taken in warm porridge (BRYANT 1966 cited in HUTCHINGS *et al.* 1996). This infusion demands 'caution' to treat stomach and intestinal ailments, as it is strongly cathartic (CUNNINGHAM 1988).

USE IN SOUTHERN AFRICA

CONSERVATION It was ranked among the most frequently demanded medicinal species in KwaZulu-Natal (MANDER 1998).

ADDITIONAL INFORMATION

Vitellariopsis dispar

FAMILY Sapotaceae

AUTHORITY (N.E. Br.) Aubrev.

SSP TAXON

SYNONYMS *Austromimusops dispar* (N.E. Br.) A. Meeuse

ENGLISH/AFRIKAANS Tugela bush milkwood (E), Tugela milkwood (E), Tugelabastermelkhout (A)

ZULU umpumbulu, pamkhulu

DESCRIPTION Bark is grey and rough (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL The rootbark is used for unspecified purposes (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION It is of lower risk status in KwaZulu-Natal (SCOTT-SHAW 1999).

ADDITIONAL INFORMATION

Vitix wilmsii

FAMILY Verbenaceae

AUTHORITY Guerke

SSP TAXON var. *reflexa* (H. Pearson) Pieper

SYNONYMS

ENGLISH/AFRIKANS hairy vitex (E), harige vingerblaar (A)

ZULU umluthu

DESCRIPTION The bark is grey; immature branches are densely pubescent (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Infusions are used as purifying emetics when a kraal member is dying (HUTCHINGS *et al.* 1996).

USE IN SOUTHERN AFRICA

CONSERVATION

ADDITIONAL INFORMATION

Warburgia salutaris

FAMILY Canellaceae

AUTHORITY (Bertol. f.) Chiov.

SSP TAXON

SYNONYMS *W. breyeri* Pott

ENGLISH/AFRIKAANS fever tree (E), pepperbark tree (E), koorsboom (A), peperbasboom (A)

ZULU amazwecehlabayo, isibaha, isibhaha

DESCRIPTION The bark is deep brown in colour, rough and marked with yellow corky lenticels; inner bark is red-toned; bark on immature branches is grey and smooth (COATES PALGRAVE 1977, VENTER & VENTER 1996).

PHYTOCHEMICAL/ PHYSICAL PROPERTIES Tannins, mannitol, and several drimane sesquiterpenoids, notably warburganol and polygodial, are present in the bark (WATT & BREYER-BRANDWIJK 1962). Mannitol is used against dyspepsia and as a diuretic (BRUNETON 1995). Warburganol, which shows molluscicidal, insect antifeedant, haemolytic and cytotoxic properties, may be responsible for the potent toxicity of inner bark extracts (HUTCHINGS *et al.* 1996). Molluscicidal activity has been attributed to muzigadial, warburganal and mukadiaal (CLARK & APPLETON 1997). Drimenin has insect antifeedant properties (HUTCHINGS *et al.* 1996); drimanes show antibacterial and anti-ulcer activity (VAN WYK *et al.* 1997). Sesquiterpenoid dialdehydes elucidated exhibit potent antifungal activity (HUTCHINGS *et al.* 1996). Muzigadial, a sesquiterpenoid, was isolated as the compound responsible for antibacterial activity (RABE & VAN STADEN 1997, 2000). Stem- and rootbark have yielded negative results for *in vitro* antimalarial tests

(WATT & BREYER-BRANDWIJK 1962). Extracts have shown *in vitro* anti-inflammatory activity (JÄGER *et al.* 1996). Phytochemical profiles of immature and mature bark are very similar to those of leaves and twigs (ZSCHOCKE & VAN STADEN 2000). The inner bark has a bitter and pepper- or ginger-like flavour, and a cinnamon-like odour (COATES PALGRAVE 1977; HUTCHINGS *et al.* 1996), for which amorphous resinous compounds are responsible (VENTER & VENTER 1996). GEORGE *et al.* (2001) noted it is a potentially commercial source of warburganol, polygodiol, drimane sesquiterpenoid lactone and mannitol, for decongestant, emenagogue, anti-bacterial and anti-ulcerative properties.

USE IN KWAZULU-NATAL It is powdered and taken in approximately 5 ml water for a dry cough, or mixed with *Cannabis sativa* leaves and smoked (BRYANT 1966 cited in HUTCHINGS *et al.* 1996). Decoctions are similarly taken to treat colds, influenza, sinus and other respiratory complaints (RABE & VAN STADEN 2000). It is also used in emetics and purgatives for febrile complaints, rheumatism and ailments induced by sorcery (intercostal neuralgia but possible rheumatism or symptoms of hepatic disease) (HUTCHINGS *et al.* 1996). MANDER *et al.* (1995) reported it an ingredient of antimalarial medicines. Powdered bark is mixed with any kind of fat and the ointment applied topically to treat inflammation, sores and skin irritations (RABE & VAN STADEN 2000). It is used for symptomatic treatment of the common cold, may be dried and powdered as a snuff to clear sinusitis, and is chewed or smoke inhaled to relieve chest complaints (COATES PALGRAVE 1977). Powdered bark is applied topically to incisions on the temples to relieve headache, and also used as an aphrodisiac (VAN WYK *et al.* 1997).

USE IN SOUTHERN AFRICA In southern Africa, *W. salutaris* is an important ingredient in tonics for many health conditions, including fever, malaria, colds and influenza, as a cough expectorant and an antibiotic to treat chest infections, venereal diseases, abdominal pain, constipation, stomach ulcers, cancer and rheumatism (VAN WYK & GERICKE 2000). It has been used as an abortifacient in Zimbabwe (GELFAND *et al.* 1985). Powdered bark may be decocted and taken in porridge to relieve abdominal pains (VENTER & VENTER 1996). In Venda, it is used to make dogs and bees more alert and aggressive (MABOGO 1990 cited in HUTCHINGS *et al.* 1996).

CONSERVATION *W. salutaris* is endangered in KwaZulu-Natal, and specially protected (HILTON-TAYLOR 1996, SCOTT-SHAW 1999). Heavy exploitation was noted by GERSTNER in 1938 (CUNNINGHAM 1988); COATES PALGRAVE (1977) noted that bark was in such high demand that material was becoming scarce, and was costly to purchase. Market supplies are smuggled into South Africa from Swaziland and Mozambique despite concerns for its survival in those countries too (DREWES *et al.* 2001). It is globally vulnerable to extinction (HILTON-TAYLOR 1996). CUNNINGHAM (1988) noted that both rural and urban herb traders in KwaZulu-Natal nominated it as the most scarce medicinal plant. It is similarly perceived as scarce on the Witwatersrand (WILLIAMS 2000), Northern Province, where bark costs on average R 1 250/kg, and Mpumalanga Province, where bark costs on average R 1 012/kg (BOTHA *et al.* 2001). In contrast, a 50 kg-sized bag of bark cost R 5 in 1960, and R 120 from gatherers at Isipingo medicinal plant market, KwaZulu-Natal, in 1988 (CUNNINGHAM 1988). DREWES *et al.* (2001) reported that bark cost R 17/kg from street traders, and R 31/kg from shop retailers, in the province. MANDER (1998) ranked it the third most frequently demanded medicinal species in KwaZulu-Natal; this ranking is influenced by its occurrence in the forest and grassland/woodland biomes. *W. salutaris* may be cultivated from seed but is more readily propagated from root suckers. It is particularly resilient to harvesting pressure, and may exhibit regrowth after complete bark removal (CUNNINGHAM & MBENKUM 1993). As a result of local extinctions in KwaZulu-Natal, the question of reintroduction has been raised, but controversy surrounds reintroduction of local clonal material or foreign (from Kenya, Tanzania and other African countries) seed (Pers. comm. BERJAK 2002³). Substitution of leaves for bark in traditional medicines is advocated by conservationists and has been validated by phytochemical investigations (ZSCHOCKE *et al.* 2000b, DREWES *et al.* 2001).

ADDITIONAL INFORMATION

³ Prof Pat Berjak, University of Natal, Durban.

Ximenia americana

FAMILY Olacaceae

AUTHORITY

SSP TAXON var. *americana*

SYNONYMS

ENGLISH/AFRIKAANS blue sourplum (E), small sourplum (E), kleinsuurpruim (A)

ZULU umkholotshwana, umthunduluka-omncane

DESCRIPTION Bark is grey, smooth to rough (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES Extracts exhibit hypotensive and antiviral effects, but not antibacterial activity (HEDBERG & STAUGARD 1989 cited in HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL It is used for unspecified purposes (POOLEY 1993).

USE IN SOUTHERN AFRICA It is used in paediatric medicine (COATES PALGRAVE 1977). In Swaziland, 50 g each of bark and roots are powdered and added to a litre of warm water, and one drop administered daily to the eye to treat eye complaints (AMUSAN *et al.* 2002).

CONSERVATION

ADDITIONAL INFORMATION

Xymalos monospora

FAMILY Trimeniaceae

AUTHORITY (Harv.) Baill.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS bog-a-bog (E), lemonwood (E), borriehout (A), lemoenhout

ZULU bokoboko, ithotshe, umhlungwane, umhlwehlwe, umzinkulu, uvethe

DESCRIPTION Bark is pale grey-brown to brown, flaking, and characteristically marked with concentric shapes (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES

USE IN KWAZULU-NATAL Powdered bark is used to treat colic (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA

CONSERVATION HUTCHINGS *et al.* (1996) reported that it is apparently not collected in Afro-montane forests where it is common.

ADDITIONAL INFORMATION

Zanthoxylum capense

FAMILY Rutaceae

AUTHORITY (Thunb.) Harv.

SSP TAXON

SYNONYMS *Fagara capensis* Thunb., *Fagara magaliesmontana* Engl., *Zanthoxylum thunbergii* DC. var. *grandifolia* Harv.

ENGLISH/AFRIKAANS adelaide spice tree (E), cardamon (E), small knobwood (E), kardamon (A), kleinperdepram (A), knopdoring (A), knoppiesdoring (A)

ZULU ambelentombi, amabelezintshingezi, isimungumabele, isinungwane, manungwane, anungwane, umlungumabele, umnungamabele, umnungwane, umnungwane omncane

DESCRIPTION The bark is grey with characteristic thick thorns (VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It may contain sanguirine or related alkaloids (VAN WYK & GERICKE 2000); sanguirine has anti-inflammatory and anti-plaque activity (low concentrations bind selectively to dental plaque and effectively inhibit bacterial growth) (VAN WYK & GERICKE 2000). Sanguirine is used in commercial toothpastes and oral rinses (VAN WYK & GERICKE 2000, BRUNETON 1995). Decoctions have an unpleasant odour, and administration is reputed to cause excessive sweating

(HUTCHINGS *et al.* 1996).

USE IN KWAZULU-NATAL Rootbark is an ingredient in decoctions known as 'imbhiza', taken orally to purify the blood, as a steam bath to treat scrofula, or an enema for stomach complaints (HUTCHINGS *et al.* 1996). Dried, ground rootbark is applied directly to relieve toothache (HUTCHINGS *et al.* 1996). Powdered stembark is rubbed into incisions along either side of the body for two days to treat paralysis; the patient may also suck a decoction from the fingertips, and then tap the affected joints (HUTCHINGS *et al.* 1996). See TREASE & EVANS (1983).

USE IN SOUTHERN AFRICA In South Africa it is used in a tonic for blood conditions (bark is scraped, pounded and chewed or made into a tea) (ROBERTS 1990). A tea of 60 ml pounded bark in 500 ml boiling water, taken in 125 ml doses up to three times daily, is used for acne and skin eruptions (ROBERTS 1990). It is also used as an antidote for snakebite: pieces of bark are chewed and swallowed at 15-minute intervals until the swelling subsides. The victim is kept warm and held still while crushed and pounded bark is applied to the bite (ROBERTS 1990). A dressing of powdered bark, or chewed pieces, is used to relieve toothache (ROBERTS 1990), and infusions are used as mouthwashes and toothache remedies (VAN WYK & GERICKE 2000). It is also used in medicines for tuberculosis, chronic coughs, bronchitis, paralysis and epilepsy (ROBERTS 1990). The bark and leaves are used together to treat anthrax (ROBERTS 1990), and gall sickness in cattle (VENTER & VENTER 1996).

CONSERVATION It germinates readily in plantations of the exotic *Acacia melanoxylon* R. Br. (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Zanthoxylum davyi

FAMILY Rutaceae

AUTHORITY (Verdoorn) Waterm.

SSP TAXON

SYNONYMS *Fagara davyi* Verdoorn, *Z. thunbergii* DC. var. *grandifolia* Harv.

ENGLISH/AFRIKAANS knobthorn (E), knobwood (E), knoppiesdoring (A), perdepram (A)

ZULU isimungumabele, isinungwane, manungwane, umanungwane, umlungumabele, umnungamabele, umnungwane, omkhulu

DESCRIPTION Bark is pale grey, becoming grey-brown with maturity, and with conspicuous knob-like thorns (COATES PALGRAVE 1977).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains resin (WATT & BREYER-BRANDWIJK 1962). See TREASE & EVANS (1983).

USE IN KWAZULU-NATAL Powdered bark is cooked and chewed to relieve severe coughs and colds (WATT & BREYER-BRANDWIJK 1962).

USE IN SOUTHERN AFRICA The Mpondo use it as a snakebite antidote: it is rubbed into the bite wound, and taken as an emetic (WATT & BREYER-BRANDWIJK 1962). It is similarly used by the Venda, and in treatment of chronic coughs, toothache, pleurisy and boils (MABOGO 1990 cited in HUTCHINGS *et al.* 1996).

CONSERVATION It is of indeterminate conservation status in KwaZulu-Natal (CUNNINGHAM 1988).

ADDITIONAL INFORMATION

Ziziphus mucronata

FAMILY Rhamnaceae

AUTHORITY Willd.

SSP TAXON

SYNONYMS

ENGLISH/AFRIKAANS buffalo thorn (E), blinkbaar-wag-'n-bietjie (A), haak-en-steek-wag-'n-bietjie

ZULU isilahla, umlahlankosi, umlahlabantu, umkhobobonga, umpafa, umphafa

DESCRIPTION The bark is rough and grey to dark grey or grey-brown and longitudinally fissured; bark on

immature branches is smooth and red-brown (COATES PALGRAVE 1977, VENTER & VENTER 1996, VAN WYK *et al.* 1997).

PHYTOCHEMICAL/PHYSICAL PROPERTIES It contains up to 15.7 % tanning matter (WATT & BREYER-BRANDWIJK 1962) or 12-15 % tannin (VENTER & VENTER 1996). Several alkaloids, structurally related to the peptide alkaloids, have been identified in the stembark (e.g. mucronine D) (TSCHESCHE *et al.* 1974 cited in VAN WYK *et al.* 1997). Members of the genus contain purgative quinones such as anthraquinones, anthranols and their glycosides (TREASE & EVANS 1983). Aqueous and methanolic extracts yielded negative antibacterial results *in vitro* (RABE & VAN STADEN 1997).

USE IN KWAZULU-NATAL Infusions prepared with a large dish of pounded bark and approximately 1 litre hot water are taken as emetics for a chronic cough or respiratory ailments (WATT & BREYER-BRANDWIJK 1962, BRYANT 1966 cited in HUTCHINGS *et al.* 1996). Steam baths made with the bark are used to purify the skin (PALMER & PITMAN 1961).

USE IN SOUTHERN AFRICA In some regions of South Africa, a tea is used for coughs, chest ailments, swollen glands, lumbago, rheumatic complaints and pains. Bark pieces are steeped in 1 litre hot water for ten minutes, allowed to cool, strained and administered in doses of approximately 125 ml (ROBERTS 1990). The bark is widely used in southern Africa, commonly against diarrhoea, dysentery, coughs and chest problems (VAN WYK & GERICKE 2000).

CONSERVATION

ADDITIONAL INFORMATION

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Analysis of information contained in the database

Literature

The limiting factors affecting this inventory were the lack of literature dealing specifically with bark, and, where barks are explicitly mentioned, vague information: omitting to detail user populations, localities, correct botanical nomenclature, sources of plant material, or methods of medicinal preparation. Forty-one books were consulted, 15 conference proceedings or investigative reports, 72 papers in refereed journals, and three flora or memoir publications. 'Grey' sources, so-called due to usually obscure locality and troublesome accessibility, included three magazine articles and anecdotal knowledge attributed to personal communications. Several grey sources, identified in electronic searches or cited in other publications, could not be accessed. CUNNINGHAM (2000) recommended that, to overcome the problem of valuable data being obscured in grey literature, copies should be deposited in recognised libraries and published in international journals. Publication on the Internet may also facilitate access to such literature.

Whilst anthropological literature may contain useful information on traditional plant use, this study focussed on ethnobotanical sources. Since the research was undertaken from a botanical perspective, the database aimed to identify the efficacy of ethnobotanical literature in serving botanical users. A comparison of anthropological and ethnobotanical sources was precluded within the available time frame. The 'recorder effect' is a common problem affecting syntheses of published information, whereby individual researchers, and researchers of different disciplines, have varied approaches to recording information and their results vary in reliability, as discussed by PEARMAN (2000). It was considered more important to identify such problems within the ethnobotanical literature, although they are acknowledged to affect records of plant use from any disciplinary perspective.

Represented taxa and trends in information

One hundred and eighty plant species, representing 108 genera and 50 families, were inventoried. Families represented by the highest number of genera (Figure 3.1) were the Euphorbiaceae (11 genera), Anacardiaceae and Celastraceae (eight genera each). Highest species representations per genus (Figure 3.2) were by *Acacia* in the Caesalpiniaceae (ten species), *Cassine* in the Celastraceae and *Euclea* in the Ebenaceae (five species each). Exotic species included *Cinnamomum camphora* (L.) J. Presl. and *C. zeylanicum* (Burch.) Baill. (Lauraceae) and an unidentified *Pinus* (Pinaceae). Those taxa with high representation in the database may not necessarily be the most popular medicinal bark species KwaZulu-Natal, but abundant in its flora. This agrees with WILLIAMS *et al.* (2000) who found a significant correlation

between the plant families used medicinally on the Witwatersrand and the southern African flora: taxa harvested and used medicinally are associated with the largest southern African floral families. Additionally, taxa occurring in extensive vegetation types and/or vegetation near traditional medicine markets have a higher probability of being used and traded (WILLIAMS *et al.* 2000).

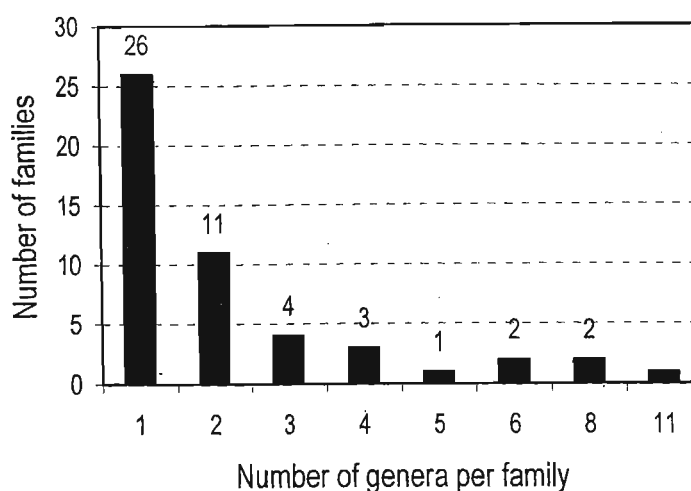


Figure 3.1 Number of families with particular number of genera inventoried for medicinal bark usage in KwaZulu-Natal

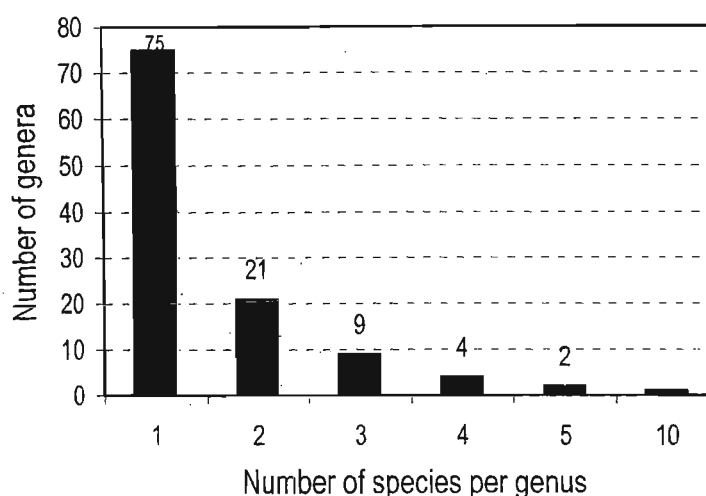


Figure 3.2 Number of genera with particular number of species inventoried for medicinal bark usage in KwaZulu-Natal

The number of taxa included in the database may be a conservative reflection of the actual number of bark species used medicinally in KwaZulu-Natal. HUTCHINGS *et al.* (1996) identified 1 032 plant species used in Zulu traditional medicine in KwaZulu-Natal. Most of the 180 species included in this database were recorded for bark usage by HUTCHINGS *et al.* (1996). At least 112 species used for their bark in traditional healthcare are harvested from indigenous forests in South Africa (CUNNINGHAM 1988, MANDER *et al.* 1997), many of which are likely to occur in KwaZulu-Natal due to floristic similarities in South African forests

(DWAF 1995, LOW & REBELO 1996). Considering species from other vegetation types (in the Grassland, Savanna and Thicket biomes) (MANDER 1998), the number of bark species used in KwaZulu-Natal may be substantially higher than presently known.

A wealth of published information is available for economically important bark species, those of high conservation priority, and those with recognised pharmacological potential. For example, *Kigelia africana* (Lam.) Benth. (Bignoniaceae) has been recognised for its pharmacological properties against cancer, and ethnobotanical and biochemical knowledge of this species is thoroughly documented (GRACE *et al.* 2002a, HOUGHTON 2002, SURVEY OF ECONOMIC PLANTS FOR ARID AND SEMI-ARID LANDS (SEPASAL) 2002B). *Cinnamomum camphora* (Lauraceae), although an invasive exotic species in South Africa, has become naturalised in the South African traditional pharmacopoeia. Its economic importance for camphor has attracted much attention, and its phytochemical properties are well known. The use of *Catha edulis* (Vahl) Forssk. ex Endl. (Celastraceae) leaves for narcotic purposes throughout Africa and Asia has similarly received extensive attention, although properties of the bark are not well known. *Prunus africana* (Hook. f.) Kalkm. (Rosaceae) bark is the source of pharmaceuticals used against prostatic hypertrophy, and its phytochemical properties and sustainable usage extensively researched (ICRAF ONLINE 2000). Similarly, *Warburgia salutaris* (Bertol. f.) Chiov. (Canellaceae) and *Ocotea bullata* (Burch.) Baill. (Lauraceae) are both under threat of extinction as a result of medicinal use in South Africa. Interest has been expressed in the therapeutic potential indicated by their traditional importance, and the possibility of using leaves instead of the less-sustainable bark (ZSCHOCKE *et al.* 2000b, DREWES *et al.* 2001, GELDENHUYS 2002a). An outcome of the differential volumes of literature for each species was uneven distribution of information in the database.

Nomenclature and synonymy

Most species shared only one English or Afrikaans vernacular name with other species, but at least three Zulu vernaculars. Nouns with the highest recurrence in the database were the English 'cherry', 'pear' and 'milkberry'; Afrikaans 'peer' [pear], 'melkhout' [milkwood] and 'stinkhout' [stinkwood]; and Zulu '(um)lamanye' [meaning 'to recover from illness']. Linguistically, vernacular nomenclature may be overdifferentiated, where a single plant species is known by many names, or underdifferentiated, where a generic term is applied to several species (CUNNINGHAM 2001). The number of vernacular terms referring to a plant is known to indicate cultural importance and usage, but some popular species are widely known by only one or two vernacular names. *Harpephyllum caffrum* Bernh. ex Krauss (Anacardiaceae) is known only as 'umgwenya' (presumably a reference to the grey bark that resembles crocodile skin), and *Cinnamomum camphora* as 'uroselina' (referring to a girls' name as the aromatic bark is used as a perfume (VAN WYK *et*

al. 1997)). Interestingly, WILLIAMS *et al.* (2001) commented that Zulu vernacular names are dominant throughout the South African medicinal plant trade, as traditional healers of other language groups have adopted them. BOTHA *et al.* (2001), for example, recorded the Zulu vernacular name 'maphipha' and 'umaphipha' for *Rapanea melanophloeos* (L.) Mez (Myrsinaceae) in Mpumalanga Province, where Sepedi, Setswana and Xitsonga are the dominant indigenous languages.

Due to synonymy of names given to different plant species, and the application of multiple names to a single species, plant identification using vernacular names is notably difficult. Vernacular nomenclature cited in the literature may be erroneous or recorded for incorrect plant species (WILLIAMS *et al.* 2001, NGWENYA & WILLIAMS 2002). Inaccuracies in the literature arise as a result of names being recorded by non-Zulu-speakers, and translation of botanical knowledge from the oral tradition to written form (NGWENYA & WILLIAMS 2002). Vernacular names are commonly spelt differently and may or may not include the prefix typical of Zulu nouns. Labels observed at herbalist shops, traditional healers' practices, and street traders' stalls in the present study similarly showed much variation in spelling and prefixes. To accommodate such variability, every name recorded in the literature was included here despite obvious repetition of names with different spelling. DOUNIAS (2000) provided a useful discussion of problems associated with linguistics in ethnobotanical research. Vernacular names may refer to a number of unrelated plant species, usually when they are used for a common purpose. BOTHA *et al.* (2001) reported that only 71 % of the vernacular names encountered in Mpumalanga markets accounted for the 176 medicinal plant species they identified, and 84 % of names for the 70 species identified in the Northern Province trade. Despite the sometimes questionable reliability of vernacular nomenclature, local vernacular names may nonetheless be useful in distinguishing between different medicinal plant products of a region.

Medicinal usage and administration

Ethnographic information captured in the database indicated that bark medicines are administered by varied methods to treat a diversity of ailments, spanning all levels of healthcare, including first aid, preventative and rehabilitative therapy, and for magical or religious purposes. Of the 180 bark species inventoried, 14 (8 %) used in KwaZulu-Natal were recorded in the literature for the treatment of external ailments (e.g. eye complaints, toothache and wounds), 77 species (43 %) for internal ailments (including purgatives, emetics and internal parasites), and 20 species (11 %) for both internal and external ailments. Of those taken internally, five are reportedly administered only by enema, 19 orally, and 20 by both; five are taken as snuff. Other recorded uses included prophylaxis against malaria (four species), first aid against snakebite, poisoning and burns (eight species) and in magical or spiritual applications, such as love charms and medicines to treat grievance (32 species). Ethnoveterinary uses were recorded for fourteen species, but

none for veterinary usage alone; in several cases, bark was used in the same manner for veterinary and medical applications. CROUCH *et al.* (2002) noted that only 45 of the 3 689 medicinal species recorded in their survey of the Flora of Southern Africa (FSA) region were used exclusively for ethnoveterinary purposes. Although the above data indicate that the majority of bark medicines are usually taken orally in therapy of internal ailments, the purposes for which 54 species (30 %) are used were unspecified, although the medicinal use of their bark is known. Since this inventory relied exclusively upon information recorded in the literature, anecdotal knowledge from traditional medical practitioners and their patients may alter the usage patterns outlined above.

HUTCHINGS (1989a) noted that, of 794 plant medicines employed by Zulu, Xhosa and Sotho cultures in South Africa, a higher proportion of monocotyledonous than dicotyledonous plants was used externally as charms and for procreation-related complaints. Dicotyledonous plants were used to treat a wider range of ailments than monocotyledonous ones (HUTCHINGS 1989a). The symbolic value of some plant products may dictate their use in certain cases. Characters for which a plant part may be favoured include colour (e.g. bark species used in 'ikhubalo' mixes in KwaZulu-Natal are all pink or red in colour (CUNNINGHAM 2000)), mucilage or latex content, pungent aroma, foul or bitter taste, and suggestive morphology (for instance the pendulous fruits of *Kigelia africana* are used throughout Africa to treat impotence).

Trends in usage and administration of medicines may indicate possible alternatives to existing practices that threaten the indigenous medicinal flora. Without further documentation and analysis of traditional healthcare in this country, such trends will remain difficult to ascertain. Varied usage and administration signify the integral role of bark medicines in South African traditional healthcare.

Conservation concerns

Of the 180 species in the database, 29 (16 %) (spanning 17 families) were described in threatened conservation categories, three of which (*Alberta magna* E. Mey., *Albizia suluensis* Gerstner and *Ocotea bullata*) were globally threatened. Seven species were considered 'not threatened'. The highest number of 'vulnerable' or 'declining' species per family was in the Celastraceae (seven species). This does not necessarily reflect the latter as the most threatened family used for bark in KwaZulu-Natal, as conservation data were limited (economic and/or management information recorded, but no indication of the level of exploitation) for a further 27 species (15 %) and absent from 85 species entries (47 %) in the database. For 19 of the 29 species with recognised conservation concerns, additional data verified that medicinal bark products were in high demand, limited in availability, and frequently expensive. Five species' conservation

status were described as 'indeterminate'; *Ekebergia capensis* Sparrm. was the single such species for which trade data were recorded, and indicated risk of exploitation.

Where trade data were recorded, the price of bark products was generally found to indicate their availability (those perceived as rare or in high demand were usually expensive), but economic data fluctuated and were sometimes inconsistent. For example, *Calodendrum capense* (L.f.) Thunb. bark was reportedly in high demand but readily available in Mpumalanga Province, costing R 33 - 435/kg (BOTHA *et al.* 2001). In contrast, *Bersama tysoniana* Oliv. bark was considered in high demand and less readily available, but was less expensive (R 11- 400/kg) (BOTHA *et al.* 2001).

Twenty-eight species (15 %) were not ascribed to any conservation category, but trade data (perceived availability, consumer demands, trade prices) suggested that these species are at high risk of exploitation for their medicinal barks. Species threatened by exploitation for the medicinal plant trade, but not classed in a conservation category, are cause for concern, since conservation and sustainable management is unlikely until they are recognised as threatened.

The spatial scale on which the conservation status of a plant species is determined frequently results in locally threatened or extinct species being overlooked at the global or provincial level (SCOTT-SHAW 1999). Since projects such as the Red Data List of southern African plants aimed to "collate and synthesize all the known information (published and unpublished) on the *threatened* vascular plants of southern Africa" (HILTON-TAYLOR 1996), threatened taxa not classified within World Conservation Union (IUCN) categories remain largely unrecognised. Conservation data for the species inventoried here were taken primarily from CUNNINGHAM (1988), HILTON-TAYLOR (1996) and SCOTT-SHAW (1999). Conservation categories in CUNNINGHAM (1988) were modified from HALL *et al.* (1980), who used the 'old' (pre-1994) IUCN Red Data categories described by DAVIS *et al.* (1986). Similarly, HILTON-TAYLOR (1996) followed the 'old' IUCN categories with minor modifications. SCOTT-SHAW (1999) presented the first assessment of the KwaZulu-Natal flora in terms of the 'new' (1994) IUCN Red Data categories. Differences in classification criteria imparted some confusion in determining the conservation status of species in the database, but in many cases provided a comprehensive picture of conservation status on the levels described by different authors.

One of the major results of many ethnobotanical projects is a database, but the data are frequently inaccessible (the most useful are sometimes presented in an index or appendix in publications and theses) and therefore ineffective (DOUNIAS 2000). Data must be available to those who can make best use of it; for example, the National Medicinal Plants Database for southern Africa, MEDBASE, led to an annotated checklist of the medicinal and magical flora of the region (CROUCH & ARNOLD 1999). The database

presented here may form a skeleton for further investigations, as a convenient synthesis of information pertaining to those species used medicinally for their bark in KwaZulu-Natal.

The database highlighted interesting trends in existing knowledge of medicinal bark species used in KwaZulu-Natal, and areas where research is needed to answer questions of management for sustainable medicinal use. The importance of bark medicines in traditional healthcare in the province, and indeed South Africa, is not clearly reflected by the literature, and poor data specificity is the key limiting factor affecting its usefulness. Conservation status and attributes relevant to the management of species used for their bark were frequently vague or absent. There is a need for research and specialist publications to address the gaps in existing knowledge of bark properties and management of plants used medicinally for their bark to conserve the South African medicinal flora.

Bark authentication in the context of South African traditional healthcare

Bark characterisation

Anatomy and morphology of bark

Bark generally refers to secondary tissues outside the vascular cambium of the root and stem. Like many spheres of plant anatomy, the study of bark is fraught with conflicting and overlapping terminology. For instance, SMALL (1929) stated that "botanically, everything outside the phellogen is known as bark, but in *materia medica* the term 'bark' is commonly used to mean everything down to the cambium, thus including the pericycle and bast (or phloem), with the fibres, etc." WOOD (1952) presented a "non-technical" term that referred to all tissues outside the wood. ROTH (1981) indicated that 'bark' requires conceptual understanding since it includes various tissue types of different origins. In this study, terminology suggested by TROCKENBRODT (1990) and JUNIKKA (1994) is followed.

Bark is correctly termed only on commencement of secondary growth. Initially the bark region is composed entirely of the primary cortical, phloem and epidermal tissues. In primary roots, an additional layer - the pericycle or pericambium - separates the cortex and vascular tissue, and gives rise to lateral roots (TROCKENBRODT 1990). By the end of the first growing season the bark region consists of remaining primary tissues, secondary phloem, periderm, and dead tissues in an outermost layer that become incorporated only after their senescence (BORGER 1973, PRANCE & PRANCE 1993). Senescence of tissues outside the periderm is induced by the insertion of non-living phellem between these and the living inner tissues (ESAU 1977).

The anatomy and principal functions of bark have been extensively investigated and are briefly highlighted here to indicate its anatomical importance and the impacts of bark removal on plant health. Bark tissues are essentially involved in the conduction of dissolved assimilates in secondary phloem, and act as a very effective protective covering of the stem and roots (ESAU 1977) against mechanical injury and pathogenic infection (BIGGS 2001). Due to the presence of air-filled cells, thermal insulation is provided and, importantly, temperature fluctuation prevented in the cambial zone (BORGER 1973). Bark may also fulfil a storage function (for example in the Rosaceae and Myrtaceae) (BORGER 1973).

Bark anatomy

On commencement of secondary growth, the epidermis is replaced by a **periderm** comprising three tissue layers: outermost phellem or cork, phellogen or cork cambium, and innermost phelloderm. The periderm effectively assumes the protective role of the epidermis. The first-formed periderm usually originates in the subepidermal layer (JUNIKKA 1994) and may remain in a superficial position, or successive periderms may arise in the phelloderm of the existing one, thereby preventing the bark being divided into layers (BORGER 1973). The tissue outside the most recently formed periderm, including cortex, primary and secondary phloem, and older periderms, is termed rhytidome (TROCKENBRODT 1990). Since the periderm strongly influences external bark morphology, and is composed of three distinctive layers, it is very useful in bark characterisation and species diagnosis (ROTH 1981).

Phellem is composed of tightly packed cells that are dead at maturity, and responsible for thermal insulation since they are impermeable (PRANCE & PRANCE 1993, JUNIKKA 1994). The suberised cell walls have waxy deposits and sometimes tannins or resins, which impart colour (PRANCE & PRANCE 1993, JUNIKKA 1994). In transverse section, phellem cells are frequently tangentially elongated and arranged in regular radial rows; in surface view, they are usually polygonal (TREASE & EVANS 1983). Because phellem cells are impervious to water, the periderm prevents desiccation and pathogenic infection of underlying tissues (BORGER 1973).

Phellogen cells appear oblong in both transverse and radial sections; in tangential section they are irregular in shape (BORGER 1973). They are typically thin-walled, and may contain tannins, starch and chloroplasts in species with photosynthetic bark (ESAU 1977). Similarly, **phelloderm** cells in photosynthetic bark may contain chloroplasts (BORGER 1973) as they too are living at maturity. The latter are typified by wall thickenings, intercellular spaces and inclusions such as starch and calcium oxalate crystals (TREASE & EVANS 1983). Phelloderm closely resembles cortical parenchyma, but the former is distinguishable by radial arrangement (BORGER 1973). In some taxa phelloderm colour has proved diagnostic, but it is commonly a green layer beneath the rhytidome, of photosynthetic importance (ROTH 1981) but of no diagnostic value (JUNIKKA 1994). ROTH (1981) noted that a certain economy dictates the proportional distribution of phellem and phelloderm, and one will be more developed than the other.

The role of the periderm in wound responses has received extensive research attention due to the importance of bark in shielding the economically important wood beneath it, and has been reviewed by BIGGS (2001). Periderm regeneration in response to wounding is an energy intensive process that serves to replace tissue and regenerate lateral meristems, re-establish controlled gaseous exchange and desiccation,

and prevent or restrict pathogenic infection (BIGGS 2001). The protective function of the periderm, against desiccation and microbial infection (MARTIN & CRIST 1970), is not exclusive to bark tissue on stems and roots, as periderm may form on some fruits and storage organs, such as *Solanum tuberosum* L. tubers. The periderm itself may assume a storage function in subterranean stems and roots, where the phellem is well developed and modified for storage, and then termed polyderm (BORGER 1973, ESAU 1977).

Since bark formation precludes the photosynthetic function, plant species in which photosynthesis is undertaken by the stem (notably those with reduced leaf structures) may show adaptive mechanisms to overcome this. For example, in species occurring in arid and semi-arid habitats, the rhytidome may be shed up to 25 years after formation to facilitate resumption of the photosynthetic role by underlying tissues (WICKENS 1998). In other arid and semi-arid species, a single periderm is maintained thereby allowing photosynthetic tissues to remain active (ROTH 1981). Gaseous exchange is facilitated by **lenticels** that replace stomata as chlorophyll-containing tissues decrease and periderm arises (BORGER 1973). Lenticels usually develop beneath stomata, but may arise in areas of the stem or root in which the latter are absent (BORGER 1973). The lenticel complex is distinguished by increased phellogen activity, loosely packed filling tissue, and an internal suberised closing layer (TROCKENBRODT 1990, PRANCE AND PRANCE 1993).

Secondary **phloem** is added to the bark region by the vascular cambium each growing season. Sieve elements, comprising sieve tube members and sieve cells, are the principal conducting elements of phloem cells. Conduction is facilitated by regions of dense sieve pores in the cell walls, termed sieve areas, and sieve plates, usually on the end walls of sieve tubes, comprising numerous sieve areas (TROCKENBRODT 1990). Companion cells are specialised living cells associated with sieve tube members (TROCKENBRODT 1990). Existing soft-walled sieve elements and parenchymatous tissues are crushed and eventually separated from recently produced phloem by new periderm, creating layers of phloem and periderm (PRANCE & PRANCE 1993).

Sieve elements comprise a large proportion of living phloem; CHANG (1954 cited in MARTIN & CRIST 1970) indicated that sieve elements comprised 54-80 % of the inner bark of gymnosperms, and > 40 % in *Quercus rubra* L. (Fagaceae). Non-functional sieve elements may impart a diagnostic pattern on the bark (ROTH 1981). Since rays pass through secondary phloem in the bark region, they are termed bark rays, whereas rays visible in the vascular cambium are termed xylem or wood rays as they originate beyond the bark (TROCKENBRODT 1990). Tangential strain caused by increased stem diameter may affect a dilatation process in the phloem, and the dilatation pattern may provide useful characters for bark identification (ROTH 1981, JUNIKKA 1994).

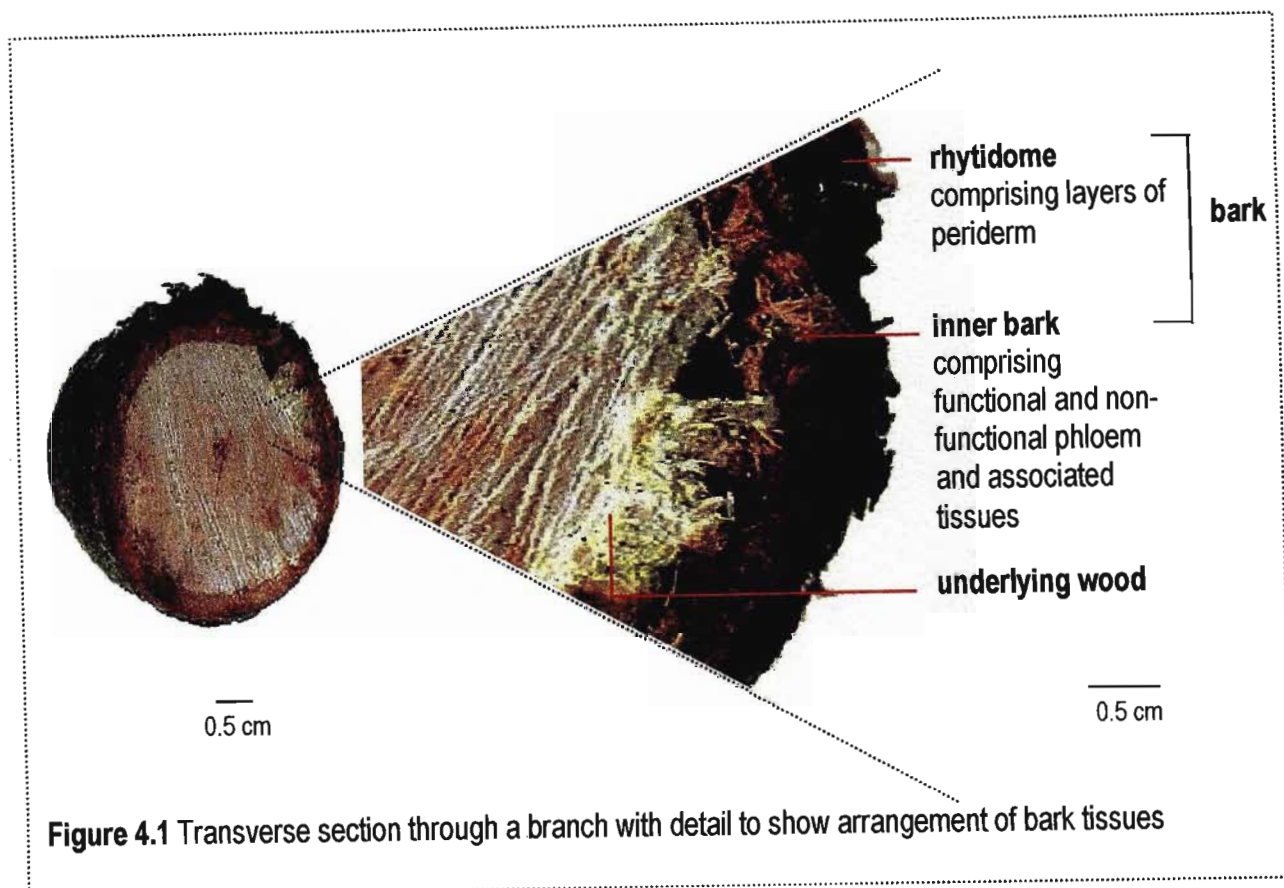


Figure 4.1 Transverse section through a branch with detail to show arrangement of bark tissues

On maturity, bark may be considered as two layers. Rhytidome or **outer bark** consists of dead phellem cells, living phellogen and phellogen layers, and any cortical and phloem tissues between them. Typically, periderms appear as thin layers in the outer bark, and are occasionally visible as darker bands interspersed with lighter layers of secondary phloem (JUNIKKA 1994). Species in which a single periderm is maintained do not form a rhytidome (ROTH 1981). In contrast, **inner bark** is entirely composed of living tissue, including functional and non-functional secondary phloem between the vascular cambium and most recent periderm. The presence of collapsed sieve elements renders phloem in the inner bark non-functional, whilst phloem nearest the cambial zone is responsible for the translocation of food substances in the familiar way. Accordingly, TROCKENBRODT (1990) suggested the tissues be termed collapsed and non-collapsed secondary phloem. The macroscopical characters of phloem may prove useful in bark identification (JUNIKKA 1994).

Associated with the periderm and phloem are other tissues found in the bark region. Bark **parenchyma** collectively refers to that occurring outside the vascular cambium, including parenchyma of cortical origin, and phloem parenchyma associated with axial and radial phloem (TROCKENBRODT 1990). The pattern of parenchyma distribution may be a useful character in bark identification (ROTH 1981). Cortex **collenchyma** that provides strengthening and support in the primary cortex may persist in the secondary bark tissues. It comprises narrow, elongated cells with unevenly thickened, non-lignified walls. If cells show

thickening of the tangential walls, the tissue is termed plate collenchyma; if the cell corners show excessive thickening, it is termed angular collenchyma, or lacunar collenchyma in the presence of intercellular airspaces (TROCKENBRODT 1990). **Sclerenchyma** is a secondarily derived tissue comprising thick-walled sclereid cells, and narrow, elongated fibres. All fibres in the region are termed **bark fibres**, but those occurring within the phloem are specifically termed as such (TROCKENBRODT 1990). Fibres are taxonomically important, as the number (SRIVASTAVA 1964), form and arrangement in which they occur may be typical of a genus or species (ROTH 1981, JUNIKKA 1994).

Specialised cells and tissues in the bark region include secretory cells, sclereids and pericyclic fibres that may be scattered or grouped in the cortex (TREASE & EVANS 1983). Parenchyma in living phloem of the inner bark is responsible for storage of starch, lipids, crystals, tannins and resins, and other ergastic contents. Although the deposition of calcium oxalate crystals in bark cells is common, the shape and size of crystals is often diagnostic to the species level (SRIVASTAVA 1964, ROTH 1981). Inner bark may also include specialised secretory cells such as laticifers and idioblasts. Laticifers secrete latex, a white liquid matrix containing terpenoids, carbohydrates, proteins, tannins, gums, mineral oils and waxes, the composition of which varies between species (PRANCE & PRANCE 1993). Latex represents a chemical anti-herbivory mechanism, and may also have toxic or medicinal properties in humans attributed to the various terpenoid compounds therein (PRANCE & PRANCE 1990). Resin, secreted by epithelial or border cells lining resin canals in the inner bark, provides a similar chemical defence mechanism against herbivory and wounding. It is usually a fragrant, viscous liquid that hardens and becomes brittle on oxidation. Oleoresins, such as turpentine, remain in the liquid phase, due to high essential oil content. The nature of exudates (WOOD 1952) and secretory structures (ROTH 1981) may be very valuable in tree identification.

Bark morphology

Bark morphology is prescribed by anatomy and environmental conditions that are strongly influential in bark development. The effects of environmental parameters on periderm formation are, in turn, expressed in bark morphology and shedding. Factors affecting periderm formation and activity include light intensity and photoperiod, temperature, soil moisture, relative humidity, and exogenous growth regulators such as ethylene (BORGER 1973). The greatest difficulty in morphological bark descriptions is the separation of inherent characters from those that arise in response to the environment (JUNIKKA 1994).

Anatomical factors affecting the external morphology of bark are the initial radial periderm position, wall thickenings in phelloderm cells, extent of cambial products, and the nature of secondary phloem in the rhytidome (PRANCE & PRANCE 1993). Outer bark may be dominated by secondary phloem, which imparts

a fibrous appearance to the bark, phellem that yields a thick, corky appearance, or alternate layers of thick- and thin-walled phellem that form paper-like layers (BORGER 1973, PRANCE AND PRANCE 1993). Bark surface patterns may be divided into several categories, and described according to a complex terminology (reviewed by JUNIKKA 1994), use of which minimises the possibility of vague and ill-defined descriptive data. The varied morphology of bark has been extensively documented, and the most common forms described here.

Species in which the periderm is maintained in a superficial position are characterised by **smooth** bark. *Quercus suber* L. (Fagaceae), the commercial source of cork, shows a distinctive type of smooth bark (BORGER 1973). Excessive phellem activity and minimal phelloderm formation result in broad bands of phellem, separated by narrow cortical layers, with the formation of successive internal peridermal layers. Due to seasonal phellogen activity, annual bands of phellem become furrowed due to tangential stress. Commercial harvesting commences when the tree is between 12 and 15 years old. The first-harvested phellem (so-called male cork) is removed mechanically at the periderm-cortex interface, stimulating a wound response. Wound periderm produces greater amounts of phellem than natural (non-wound responsive) ones, of finer quality (female cork), that is harvested at 10-year intervals thereafter (BORGER 1973).

Species with smooth green or brown barks usually maintain an actively photosynthetic periderm, from which the outermost layer of dead phellem cells is thin or absent. This is typical of species occurring in arid and semi-arid environments, where leaf area is compromised to reduce water loss to transpiration, but photosynthetic capacity maintained by the bark (PRANCE & PRANCE 1993). In contrast, well-developed phellem is typical of species subject to frequent fire (e.g. those occurring in deciduous forests and savannah habitats), as it insulates underlying living tissues and is resilient to burning (PRANCE & PRANCE 1993).

Periderm development in species with **scale bark** remains superficial until maturity is reached, when successive periderms arise internally to the existing one. Discontinuous formation of new periderm effectively separates an increasingly thick rhytidome from underlying phloem tissues. Due to increased circumference of the root or stem, the rhytidome is exfoliated in flakes, sheets or plate-like strips. Shedding is influenced by the anatomy of phloem in relation to new periderms forming therein (BORGER 1973). JUNIKKA (1994) distinguished bark flakes as patches of outer bark > 7.5 cm in length, and scales as < 7.5 cm in length. The distinctive peeling bark of *Acacia sieberiana* DC. (Mimosaceae), used medicinally in KwaZulu-Natal, exemplifies scale bark. That of the exotic *Pinus patula* Schiede ex Schltldl. & Cham. (Pinaceae), probably used in traditional healthcare in KwaZulu-Natal, exemplifies an adherent (scales retained for some time) scale bark.

Another exotic medicinal bark species used in KwaZulu-Natal, *Cinnamomum camphora* (L.) J. Presl. (Lauraceae) represents an example of **furrowed bark**. The latter is similar to scale bark, as the periderm is maintained in a superficial position until new ones are formed internally. However, unlike scale barks, the bark does not crack and peel, as a strong network of sclerenchyma fibres in the phloem 'knits' rhytidome tissues together, which are tightly adhered to the periderm. As new periderms arise beneath the initial one, a furrowed, loose and fibrous rhytidome is formed, that may accumulate to a depth of 50 mm (BORGER 1973).

Several species of *Eucalyptus* (Myrtaceae) differ from the usual pattern of furrowed bark, as the fibrous network is loose rather than rigid. It is composed of phloem fibres and phellem cells, not sclerenchyma (BORGER 1973). These barks are referred to as 'stringy'. Like most furrowed barks, fissures develop as a result of discontinuous periderm formation and increased girth, the rhytidome accumulates, and shedding occurs slowly by abrasion (BORGER 1973).

Incomplete exfoliation of rhytidome in **ring barks** results in a characteristic shaggy appearance. In such unusual species, the original periderm arises in the outer primary phloem, and successive periderms arise internally to it. Cylinders of rhytidome formed by successive periderm activity are prevented from complete exfoliation by aggregations of phloem fibres connecting the rhytidome to underlying phloem (BORGER 1973). The rhytidome is shed annually in one or many phases (JUNIKKA 1994). The economically important *Vitis* spp. (Vitaceae) exemplify ring bark (BORGER 1973).

Some species are characterised by prominent lenticels visible to the naked eye (PRANCE & PRANCE 1993). This is typical of smooth-barked species (e.g. *Prunus* spp. (Rosaceae)), where lenticels become horizontally elongated with age (BORGER 1973). In species with furrowed or scale bark, lenticels rarely exceed several millimetres in aperture (ESAU 1977). Bark thickness generally increases with stem age and diameter, but the percentage stem volume occupied by bark generally decreases with age and reduced vigour (BORGER 1973, ROTH 1981). Although bark thickness is genetically determined (for example, forest trees show thinner bark than those in fire-prone habitats), it is further influenced by environmental factors. WOOD (1952) reported that bark thickness increased in some species in exposed conditions, but decreased in others. Bark mass per tree generally increases with increased diameter and height, and calculation thereof may be useful when considering yields expected from cultivated stock (CUNNINGHAM 2001).

Bark morphology can be very useful for tree identification in the field, as it is frequently typical at least at the genus level, and sometimes the species level (*Acacia xanthophloea* Benth. (Mimosaceae) is easily identifiable by the exceptional yellow-green, powdery bark). Furthermore, reliable bark characters may ease

the identification of species that are difficult to identify from herbarium material, or those with inaccessible canopies that hinder collection of herbarium specimens (JUNKKA 1994). Bark morphology, odour, flavour, characteristics of a slash wound, and exudates, may provide reliable information in field identification of trees to the generic or specific level, and have been extensively documented (BEARD 1944, WOOD 1952, WHITMORE 1961, ROTH 1981, TAIT & CUNNINGHAM 1988, PRANCE & PRANCE 1993, JUNIKKA 1994, CUNNINGHAM 2001). Rootbark may also be useful in field identification; CUNNINGHAM (2001) noted that many members of the Celastraceae are typified by flaking orange rootbark, some members of the Ebenaceae have distinctive black rootbark with yellow or orange cross-section, and *Warburgia* spp. (Canellaceae) rootbark has the characteristic pepper odour of the stembark.

There have been several attempts to construct keys based on bark morphology, but reliable data contained in such keys are available for only a few regions, and fewer plant groups (JUNIKKA 1994). For example, BEARD (1944) compiled a key to some trees occurring in Tobago, according to bark texture, the presence of spines and latex. DE ROSAYRO (1953 cited in ROTH 1981) used external and internal bark characters, stem characters and exudates to key trees in a wet evergreen forest in Ceylon [Sri Lanka]. BAMBER (1962 cited in ROTH 1981) compiled a dichotomous key for 61 species in the Myrtaceae according to rhytidome and phellem characters, and the nature of bark crystals and fibres. NANKO & CÔTÉ (1980) described the bark anatomy of 13 species found in American pine plantations, according to characters of functional and non-functional secondary phloem, periderm and rhytidome. ROTH (1981) used a complex system of anatomical characters (sclerenchyma distribution, ray types, secretory structures, canal sheath parenchyma, crystals and lenticel properties) in her thorough account of tropical bark species.

Although useful in tree identification, field characters are of limited value for identification of excised bark products due to their usually ephemeral nature, and because they are sometimes obvious to experts only. The single available key to some common South African medicinal barks is that of TAIT & CUNNINGHAM (1988), based on morphological characters such as odour, flavour, texture, presence or absence of oxalate crystals.

Techniques for the authentication of bark medicines

Anatomical techniques

Bark anatomy is widely dismissed as too variable to be reliable for taxonomic purposes. MARTIN & CRIST (1970) noted that because there are "almost endless" variations in the pattern of phloem and periderm layers, bark can be used for identification only between species groups. However, in some cases

anatomical studies have yielded useful trends to augment taxonomic studies. WHITMORE (1961) identified seven distinct bark types in 103 species of Malaysian Dipterocarpaceae, and reported that subjective field characters were converted to objective features with analyses of bark tissues. Similarly, bark surface patterns were correlated with internal structure, and two bark types identified, in 12 southern African species of the genus *Eugenia* (Myrtaceae) (VAN WYK 1985). Bark anatomy and morphology may generally be more useful in species identification than wood anatomy, which is notably variable, but comparatively well documented (SCHWEINGRUBER 1978, BAREFOOT & HAWKINS 1982).

Traditionally, bark anatomy has offered the primary means for identification and authentication of medicinal bark products. Today, most plant drugs included in pharmacopoeia are identifiable by chemical standards (TREASE & EVANS 1983), but microscopy remains an important tool in the authentication or identification of plant materials, especially for powdered drug mixtures (JACKSON & SNOWDON 1990). Successful identification of authentication is reliant on recognition of microscopical diagnostic cell types and ergastic contents (TREASE & EVANS 1983). To overcome problems of variability in vegetable drugs, WALLIS (1965) recommended that the constituents be identified then quantified in comparative assays with known reference samples. According to TREASE & EVANS (1983), plant drug characterisation should aim to determine tissue and cell size, cell shape and relative positions, and the chemical nature of cell walls and cell contents. JACKSON & SNOWDON (1990) considered specific cell types and calcium oxalate crystals the most diagnostic features of vegetable drugs.

Diagnostic characters of unprocessed and powdered bark samples are determinable by morphological (organoleptic) and anatomical analyses. Powdered bark drugs always include sieve tubes and cellulose parenchyma, and may also comprise phellem, fibres, sclereids, starch, calcium oxalate and secretory cells (TREASE & EVANS 1983). If contaminated with wood, a bark sample may include fragments of xylem tissue (TREASE & EVANS 1983). Further characterisation with various chemical and physical tests, such as histological staining, ash analyses, and fluorescence behaviour, are commonly employed in investigations of bark pharmacognosy (JOLLY 1966, SANYAL & DATTA 1981, 1986). SRIVASTAVA (1964) cautioned that chemical analyses of cell wall components and ergastic content should be used only within the context of thorough anatomical studies of processed and unprocessed bark samples. Although cell and tissue characters may change as secondary growth occurs, on maturity they may present anatomical features diagnostic of certain taxa and prove valuable in identifying and classifying plants (TREASE & EVANS 1983).

Chemical techniques

Chemotaxonomic characters, many of which are definitive for a taxon, may be of greater significance than morphological characters for plant identification (TREASE & EVANS 1983), and chemical analyses (notably chromatography) are now accepted as standard techniques for the identification of plant materials (JACKSON & SNOWDON 1990). In addition to morphological and anatomical characters, chemical data are important indicators of plant relationships at a different level of structural organisation (ROGERS *et al.* 2000). Reliable chemical characters are those that are exclusive to specialist groups; ubiquitous primary compounds and those typical of higher taxonomic levels have little value in separating taxa (SRIVASTAVA (1964). For example, members of the bacterial genus *Streptomyces* (Actinomycetes) may be loosely classified according to chemical profiles yielded by Thin Layer Chromatography (TLC) of hydrolysed cell wall extracts (GIBBONS & GRAY 1998). Because plant extracts are usually complex mixtures of different compounds, other chromatographic techniques may be necessary in the characterisation of herbal drugs (JORK *et al.* 1990, GIBBONS & GRAY 1998).

In general, chemical investigations of bark have followed the standard procedures of wood analyses, where powdered material is extracted and analysed chemically (SRIVASTAVA 1964). Because the ergastic contents extracted from bark tissues differ, and the proportion of tissues is altered with age, qualitative assessment is perhaps more useful in the case of bark extracts, due to the possibility of discrepancies in quantitative data (SRIVASTAVA 1964). For instance, STEWART & STEENKAMP (2000) reported that simple chromatographic and colour test procedures were effective in screening some South African traditional remedies for the presence of toxic principles commonly responsible for poisoning cases.

With problems of adulteration and substitution, there is a growing need for low-cost, repeatable and reliable techniques to identify bark species used in traditional South African medicine. Due to the practical difficulties of working with bark tissue, the use of simple chromatographic methods in the first instance meets these requirements. However, identification or authentication of bark by chemical means is complicated by inherent and seasonal variations in ergastic contents (SRIVASTAVA 1964). In temperate species, for example, it is well known that starch in the bark almost disappears, whilst fats increase greatly, during winter (SRIVASTAVA 1964). Such patterns have not been investigated in tropical species, and, in the absence of seasonal climatic extremes, the possibility exists that ergastic levels may not fluctuate as markedly as in temperate species. Anatomical and morphological bark characters remain important to augment chemical methods of identification and address variability.

Problems affecting authentication of medicinal bark products in South African traditional healthcare

Medicinal bark products used in traditional healthcare in South Africa are difficult or impossible to identify. The margin of error in identifying plant medicines is broadened as a result of characteristics of South African traditional healthcare.

Bark products are used and traded in dried form, and many diagnostic morphological characters are lost through desiccation. Most problematic are those bark products sold in mixtures with other plant products, although the majority of bark medicines are administered alone (KOKWARO 1995).

A high degree of synonymy exists in the nomenclature applied to traditional plant medicines (Chapter 3). A single vernacular name may refer to more than one species that may be used for different medical purposes. For example, *Sideroxylon inerme* L., *Mimusops caffra* E. Mey. ex A. DC. and *M. obovata* Sond. (all Sapotaceae) are known in Zulu as 'amasethole' but, according to the literature, their barks are used for different medicinal purposes. Alternatively, a species may be known by many different vernacular names, some of which are shared with others, further complicating the identification of medicinal products.

Commercialisation of traditional healthcare in South Africa led to the current scenario where medicinal plant harvesters, and those who sell them to the consumer, may be inexperienced in the identification of medicinal plants. Adulteration of medicinal plant products may further affect their use. Limited availability of medicinal barks, and increased demands, exaggerate these problems. Changes in the composition of traditional medicines in response to changing circumstances may negatively impact upon efficacy, patient safety, and control of this important source of primary healthcare.

The need to authenticate medicinal plant products

Among the many ethnomedical plant taxa used in South Africa, relatively few may give rise to serious toxicity (STEWART & STEENKAMP 2000) although the South African flora includes many with toxic properties (SAVAGE & HUTCHINGS 1987) or potential toxicity to various animals (including humans) at different life stages (STEYN 1934). PUJOL (1990) noted that relatively few toxic plant species have been recognised as such, due to their medicinal value. Poisoning from traditional medicines is usually a consequence of misidentification, incorrect preparation or inappropriate administration and dosage (STEWART & STEENKAMP 2000), frequently due to self-administration (POPAT *et al.* 2001), rather than innate risks affecting the use of traditional healthcare. Indeed, traditional medical practitioners have considerable knowledge of medicinal plants and how to avoid acute poisoning (SAVAGE & HUTCHINGS

1987). For instance, *Synadenium cupulare* (Boiss.) L. C. Wheeler (Euphorbiaceae) is considered so toxic in West Africa that birds flying over the trees are killed; this myth effectively serves to discourage the layman from harvesting and using the bark without guidance from a traditional medical practitioner (CUNNINGHAM 1990a).

Misidentification of bark products may result in poisoning due to incorrect material being employed in medicines, negative effects on synergistic relationships between ingredients, and incorrect dosages. The principal reasons for misidentification of material by traditional healers and their students is usually a consequence of being unfamiliar with flora outside their locality, and not being fully trained in identifying processed material, should they purchase it from a trader (Pers. comm. NDLOVU 2001¹). However, the majority of traders in Durban medicinal plant markets (and possibly elsewhere in KwaZulu-Natal) collect their own material and are unlikely to misidentify it (Pers. comm. MANDER 2001²).

Misadministration of medicinal bark products is more likely the result of purposeful adulteration by medicinal plant retailers, traders and untrained traditional medical practitioners. Indeed, the motivation to market medicinal plants is frequently not to provide an essential service, but to make money (MANANA & ELOFF 2001). Whilst highly trained practitioners of traditional healthcare are reliable sources of medicine, traders are seldom qualified (CUNNINGHAM 1988), and there is an increasing abundance of charlatan healers who are not formally appointed and trained (BODENSTEIN 1977, CUNNINGHAM 1988, BYE & DUTTON 1991, NGUBANE 1992). BODENSTEIN (1973) noted that many practitioners of traditional healthcare do not possess formal training but sufficient knowledge, skill and experience of it to practice successfully. So-called middlemen, who are commissioned by traditional practitioners to collect the materials they require (in contrast to gatherers, who are not commissioned), play an increasingly prominent role in the traditional healthcare sector. Since these middlemen are seldom trained, their business impacts upon the quality and safety of medicinal plants used by traditional medical practitioners (TSHISIKHAWE & MABOGO 2002).

Consumers are reliant upon the person from whom medicine is purchased to correctly identify the material, but under current circumstances where the seller may not be sufficiently trained, patient safety is jeopardised. In addition, many highly toxic plants are available over the counter from herbalist retailers and medicinal plant traders, without regulation (BODENSTEIN 1973, CUNNINGHAM 1988, POPAT *et al.* 2001). Several anecdotal reports received during the course of this study confirmed that many people will no longer

¹ Mr Elliot Ndlovu, Traditional Medical Practitioner, Pietermaritzburg.

² Mr Myles Mander, Institute of Natural Resources, Pietermaritzburg.

make use of traditional medicines, unless a practitioner is recommended by a familiar source, due to scepticism regarding reliability and safety.

Acute poisoning due to traditional medicines is not uncommon in South Africa, but due to insufficient data, estimates of mortality range from 8 000 (BRADSHAW 1991 cited in THOMSON 2000) to 20 000 per annum (THOMSON 2000). According to VAN RENSBURG & MANS (1982 cited in THOMSON 2000), accidental poisoning by traditional medicines was the second-most common cause of death among black South Africans. In contrast, poisoning cases in white South Africans are typically deliberate and involve narcotic drugs (JOURBERT & SEBATA 1982). JOURBERT & SEBATA (1982) reported that 18 % of acute poisoning cases (of which 26 % resulted in death) admitted to a Pretoria hospital in a 12-month period were attributed to traditional medicines. Of the different causative agents of acute poisoning, traditional medicines resulted in the highest mortality (51.7 %) recorded in another study (VENTER & JOURBERT 1988). STEWART *et al.* (1999) reported that 43 % of poisoning cases recorded in a forensic database for Johannesburg (from 1991 to 1995) were caused by traditional plant medicines. The symptoms and causes of death from traditional medicine toxicity are very similar to the major causes of death among the black population in South Africa (diarrhoea, renal failure, hepatic failure, respiratory distress and cardiac failure) and therefore affect the accuracy of mortality data relating to traditional medicine toxicity (THOMSON 2000). Furthermore, many cases of poisoning remain unrecorded, and mortality from traditional plant medicines may be higher than currently recorded (THOMSON 2000, POPAT *et al.* 2001). Similarly, morbidity caused by the use of traditional medicines may be significantly higher than presently estimated. For example, *Callilepis laureola* DC. (Compositae) was identified as the primary cause of the high occurrence of liver necrosis recorded in the black population of KwaZulu-Natal in the 1970s (WAINWRIGHT & SCHONLAND 1977, WAINWRIGHT *et al.* 1977 cited in POPAT *et al.* 2001). BODENSTEIN (1977) reported that, because symptoms of toxicity from excessive and incorrect self-administration of *Iboza riparia* (Hochst.) N.E. Br. (Labiatae) resembled those of severe venereal infection, patients seldom connected the plant medicine to their illness.

The need for rapid and effective methods of authentication of traditional medicines therefore arises largely from the current situation in South Africa, rather than from problems inherent to traditional healthcare. When Western healthcare is consulted in poisoning cases, hospitalisation is frequently delayed (hospitals may be inaccessible or unacceptable) and toxicity therefore in advanced stages on admission (STEWART & STEENKAMP 2000). Demographics usually indicate that the majority of traditional medicine-related poisoning cases are paediatric (JOURBERT & SEBATA 1982, SAVAGE & HUTCHINGS 1987, STEWART & STEENKAMP 2000, POPAT *et al.* 2001). In KwaZulu-Natal, the majority of children who attend both rural and urban hospitals or clinics have received traditional medicines, and 56 % of Zulu- or Xhosa-speaking

parents at two semi-rural clinics in Durban had administered enemas, usually of traditional remedies, to their children (ANONYMOUS 2001). Besides potentially toxic dosages of traditional medicines, administration by enema may cause fatal internal damage to children (SAVAGE & HUTCHINGS 1987). In hospitalised poisoning cases, the implicated traditional medicine is seldom identified, or remains undisclosed since the use of traditional medicine is sometimes secret or, more commonly, frowned upon by Western healthcare (SAVAGE & HUTCHINGS 1987, STEWART & STEENKAMP 2000, POPAT *et al.* 2001). There is increasing recognition, however, that traditional medicines may have been taken for the same symptoms that led the patient to consult Western healthcare, and not caused them (SAVAGE & HUTCHINGS 1987).

Besides toxicity cases, there are numerous other scenarios in which traditional plant medicines need to be identified or authenticated. For example, TAIT & CUNNINGHAM (1988) and SCOTT-SHAW (1990) noted that accurate plant identification would empower resource managers in salvaging medicinal plants from sites scheduled for development, and in confiscating protected medicinal plants (rather than common species) from illegal gatherers. Authentication of medicinal plant material sold by wholesalers, retailers and informal traders would facilitate economic monitoring of the industry, and provide useful data for conservation monitoring (CUNNINGHAM 1988, MANDER 1998). The need for methods to identify and authenticate medicinal plant products in South Africa is an important one.

A study of some traditional bark medicines affected by problematic identification

Introduction

In order to assess the extent to which problematic identification affects the appropriate use of medicinal bark products in traditional healthcare in KwaZulu-Natal, an esteemed traditional medical practitioner in the province, Mr Elliot Ndlovu, was consulted. He selected 35 medicinal bark species as frequently misidentified by student practitioners, medicinal plant traders and consumers (Table 5.1). Although the species may not necessarily prove difficult to recognise in the field, dried bark products in semi-processed or processed form might. From the species identified by Mr Ndlovu, and through further discussion of medicinal bark species that may be substituted by others, the following eight species were selected for studies that examined the morphology and authentication of medicinal bark products.

It is well known that, due to similarities in leaf and bark morphology, *Ekebergia capensis* and *Harpephyllum caffrum* are frequently confused in the field, and medicinal bark products therefore difficult to distinguish. Despite its distinctive bark, *Acacia sieberiana* may be purposefully or mistakenly substituted for that of *Albizia adianthifolia*. Cases in which medicinal bark products are safely substituted include the use of *Schotia brachypetala* instead of *E. capensis* (not vice versa), *Croton sylvaticus* instead of *A. sieberiana*, *A. adianthifolia* and *Acacia xanthophloea* (not vice versa), and *H. caffrum* instead of *Rapanea melanophloeos* (not vice versa). Due to the complex usage patterns described above, morphological characteristics and the relevance of phytochemical characters (Chapter 6) were investigated to distinguish between medicinal bark products of these species.

Table 5.1 Medicinal bark species frequently misidentified in traditional healthcare in KwaZulu-Natal, South Africa

Family	Genus	Species	Authority	Zulu vernacular name
Anacardiaceae	<i>Harpephyllum</i>	<i>caffrum</i> *	Bernh. ex Krauss	<i>umgwenya</i>
	<i>Sclerocarya</i>	<i>birrea</i>	(A. Rich.) Hochst.	<i>umganu</i>
Apocynaceae	<i>Rauvolfia</i>	<i>caffra</i>	Sond.	<i>umhlambamanzi</i>
Aquifoliaceae	<i>Ilex</i>	<i>mitis</i>	(L.) Radlk.	<i>dumaphansi</i>
Asclepiadaceae	<i>Secamone</i>	<i>gerrardii</i>	Harv. ex Benth.	<i>iphophoma</i>
Capparaceae	<i>Boscia</i>	<i>albitrunca</i>	(Burch.) Gilg & Ben.	<i>umvithi</i>
		var. <i>albitrunca</i> ; var. <i>macrophylla</i>	Tölken Tölken	
	<i>Cassine</i>	<i>crocea</i> (syn <i>Eleodendron</i> <i>croceum</i>)	(Thunb.) Kuntze	<i>ingwavuma</i>
	<i>Cassine</i>	<i>papillosa</i>	(Hochst.) Kuntze	<i>usehlulamanye</i>
	<i>Cassine</i>	<i>transvaalensis</i>	(Burt Davy) Codd.	<i>ingwavuma</i>
	<i>Warburgia</i>	<i>salutaris</i>	(Bertol.f.) Chiov.	<i>isibaha</i>
Cornaceae	<i>Curtisia</i>	<i>dentata</i>	(Burm.f.) C.A. Sm.	<i>umlahleni</i>
Euphorbiaceae	<i>Andrachne</i>	<i>ovalis</i>	(Sond.) Müll. Arg.	<i>umbesa</i>
	<i>Croton</i>	<i>sylvaticus</i> *	Hochst.	<i>amahlabekufeni</i>
Fabaceae - Caesalpiniaceae	<i>Schotia</i>	<i>brachypetala</i> *	Sond.	<i>ihluze, umgxamu</i>
Fabaceae - Mimosaceae	<i>Acacia</i>	<i>caffra</i>	(Thunb.) Willd.	<i>umtholo</i>
		<i>karroo</i>	Hayne	<i>umnga</i>
		<i>sieberiana</i> *	DC.	<i>umkhamba</i>
		<i>xanthophloea</i> *	Benth.	<i>umkhanyakude</i>
	<i>Albizia</i>	<i>adianthifolia</i> *	(Schumach.) W. Wight	<i>umgadankawa</i>
Lauraceae	<i>Ocotea</i>	<i>bullata</i>	(Burch.) Baill.	<i>nukami</i>
	<i>Cryptocarya</i>	<i>latifolia</i>	Sond.	<i>umkhondweni</i>
		<i>myrtifolia</i>	Stapf	<i>umkhondweni</i>
Meliaceae	<i>Ekebergia</i>	<i>capensis</i> *	Sparrm.	<i>umnyamathi</i>
	<i>Trichilia</i>	<i>dregeana</i>	Sond.	<i>umkhuhlu</i>
Melanthaceae	<i>Bersama</i>	<i>lucens</i>	(Hochst.) Szyszyl.	<i>undiyaza</i>
Myrsinaceae	<i>Rapanea</i>	<i>melanophloeos</i> *	(L.) Mez	<i>maphipha</i>
Myrtaceae	<i>Syzigium</i>	<i>cordatum</i>	Hochst.	<i>umdoni</i>
Ptaeroxycaceae	<i>Ptaeroxylon</i>	<i>obliquum</i>	(Thunb.) Radlk.	<i>umthathe</i>
Rhamnaceae	<i>Helinus</i>	<i>integrifolius</i>	(Lam.) Kuntze	<i>ubhubhubhu</i>
	<i>Ziziphus</i>	<i>mucronata</i>	Willd.	<i>mhlantoksi</i>
Rosaceae	<i>Prunus</i>	<i>africana</i>	(Hook.f.) Kalkm.	<i>inyazangoma</i> <i>elimnyama</i>
Rubiaceae	<i>Burchellia</i>	<i>bubalina</i>	(L.f.) Sims	<i>iqongqo</i>
Rutaceae	<i>Calodendrum</i>	<i>capense</i>	(L.f.) Thunb.	<i>umemezi</i> <i>omhlope</i> ; <i>umbhaba</i>
		<i>Zanthoxylum</i>	<i>capense</i>	(Thunb.) Harv.
Sterculiaceae	<i>Dombeya</i>	<i>rotundifolia</i>	(Hochst.) Planch.	<i>unhliziyonkulu</i>

*Species considered in further studies.

Methodology

Bark of each study species was harvested from three mature specimens occurring in different localities in KwaZulu-Natal (Table 5.2). Three additional samples of *A. xanthophloea* were required for more comprehensive laboratory investigations (Chapter 6). Although sample sizes were limited, they accounted for genotypic and phenotypic variation between populations, as well as seasonal, geographic and other environmental variables. Where permissible, bark was harvested from the main stem or first branch, but in some cases a single small branch (ca. 10 cm in diameter) was removed for its bark. In areas where trees are exploited for their bark, harvesting from the main stem may have set a precedent for further exploitation¹.

Table 5.2 Collection localities and voucher numbers of study specimens (all numbers those of OM Grace)

Study species	Collection locality in KwaZulu-Natal	Voucher number
<i>Ekerbegia capensis</i>	National Botanical Gardens, Pietermaritzburg	54
	Krantzkloof Nature Reserve, Kloof	5
	Silverglen Nature Reserve, Chatsworth	1
<i>Harpephyllum caffrum</i>	National Botanical Gardens, Pietermaritzburg	55
	Silverglen Nature Reserve, Chatsworth	2
	University of Natal Botanic Gardens, Pietermaritzburg	18
<i>Rapanea melanophloeos</i>	National Botanical Gardens, Pietermaritzburg	11
	Krantzkloof Nature Reserve, Kloof	8
	Silverglen Nature Reserve, Chatsworth	20
<i>Schotia brachypetala</i>	National Botanical Gardens, Pietermaritzburg	12
	Krantzkloof Nature Reserve, Kloof	10
	University of Natal Botanic Gardens, Pietermaritzburg	19
<i>Acacia sieberiana</i>	National Botanical Gardens, Pietermaritzburg	51
	Krantzkloof Nature Reserve, Kloof	6
	Silverglen Nature Reserve, Chatsworth	13
<i>Acacia xanthophloea</i>	National Botanical Gardens, Pietermaritzburg	52
	University of Natal Agricultural Campus, Pietermaritzburg	21
	University of Natal Botanic Gardens, Pietermaritzburg	16
	Institute of Natural Resources, Scottsville	22
	Durban Road shopping centre, Scottsville	23
	University of Natal Main Campus, Pietermaritzburg	24
<i>Albizia adianthifolia</i>	Cascades Farm, Waterfall	15
	Krantzkloof Nature Reserve, Kloof	7
	Silverglen Nature Reserve, Chatsworth	14
<i>Croton sylvaticus</i>	National Botanical Gardens, Pietermaritzburg	53
	Krantzkloof Nature Reserve, Kloof	9
	University of Natal Botanical Gardens, Pietermaritzburg	17

¹ At Silverglen Nature Reserve, trees had been heavily exploited and most were painted with PVA emulsion to discourage medicinal harvesting. Care was taken to harvest unpainted bark from such trees for this study.

A comparative study was undertaken to investigate similarities between medicinal bark products and reference material of each species. Three medicinal bark products, purportedly of each study species, were purchased from different herbalist retailers in Pietermaritzburg (Table 5.3). To test the local reliability of vernacular nomenclature recorded in the literature, the shop attendant was proffered a photograph of the species in the field and a list of vernacular names, and asked to identify the Zulu name familiar to him or her. Similarities in the bark products purchased indicated the method was effective in communicating the product required. Since plant gatherers usually supply only one retailer (CUNNINGHAM 1988), it was unlikely that medicinal products purchased from different retailers originated from the same source.

Table 5.3 Retailers from which medicinal bark products were purchased and voucher numbers (all numbers those of OM Grace)

Purported species	Zulu vernacular name	Retailer from which product was purchased	Voucher number
<i>Ekebergia capensis</i>	<i>isimanaye</i>	117 Retief Street, Pietermaritzburg	39
		111 Retief Street, Pietermaritzburg	40
		369 Pietermaritz Street, Pietermaritzburg	41
<i>Harpephyllum caffrum</i>	<i>umgwenya</i>	117 Retief Street, Pietermaritzburg	42
		111 Retief Street, Pietermaritzburg	43
		369 Pietermaritz Street, Pietermaritzburg	44
<i>Rapanea melanophloeos</i>	<i>ikhubalwane</i>	117 Retief Street, Pietermaritzburg	45
	<i>isicalaba</i>	111 Retief Street, Pietermaritzburg	46
	<i>maphipha</i>	369 Pietermaritz Street, Pietermaritzburg	47
<i>Schotia brachypetala</i>	<i>ihlusi</i>	117 Retief Street, Pietermaritzburg	48
		111 Retief Street, Pietermaritzburg	49
		369 Pietermaritz Street, Pietermaritzburg	50
<i>Acacia sieberiana</i>	<i>umkhamba</i>	117 Retief Street, Pietermaritzburg	25
		111 Retief Street, Pietermaritzburg	26
		369 Pietermaritz Street, Pietermaritzburg	27
<i>Acacia xanthophloea</i>	<i>umdlovune</i>	117 Retief Street, Pietermaritzburg	28
	<i>umkhanyagude</i>	111 Retief Street, Pietermaritzburg	29
		369 Pietermaritz Street, Pietermaritzburg	30
<i>Albizia adianthifolia</i>	<i>igowane</i>	117 Retief Street, Pietermaritzburg	31
	<i>umgadankawu</i>	111 Retief Street, Pietermaritzburg	32
		369 Pietermaritz Street, Pietermaritzburg	33
<i>Croton sylvaticus</i>	<i>amahlabekufeni</i>	117 Retief Street, Pietermaritzburg	34
		111 Retief Street, Pietermaritzburg	37
		369 Pietermaritz Street, Pietermaritzburg	38

Following the literature, a protocol was drawn up for the characterisation of bark specimens, using several potentially diagnostic features (Table 5.4). Each fresh specimen was described according to the protocol and photographed prior to, and following, being dried overnight in an oven (50°C). Medicinal bark products were similarly described according to the protocol despite already being dried. Material was gently

scraped with a blade to remove algae, lichen and moss, as their phytochemical properties could influence the phytochemical profiles of bark extracts (Chapter 6). For example, some South African lichen species have indicated anti-inflammatory activity *in vitro* that compares favourably with that of higher plants similarly screened (JÄGER *et al.* 1997).

Table 5.4 Description protocol for the characterisation of bark specimens

Character	Descriptive data
Origin	Trunk/branches/roots
Outer surface	Colour, texture, presence of lower plants, appearance following scraping
Inner surface	Colour, texture
Fracture	Broken bark splintered/fibrous/granular
Odour & taste	Distinctive odour and flavour of bark
Shape	Curvature after drying, according to TREASE & EVANS (1983). See Figure 5.1
Milled material	Description of bark ground in a mechanical mill

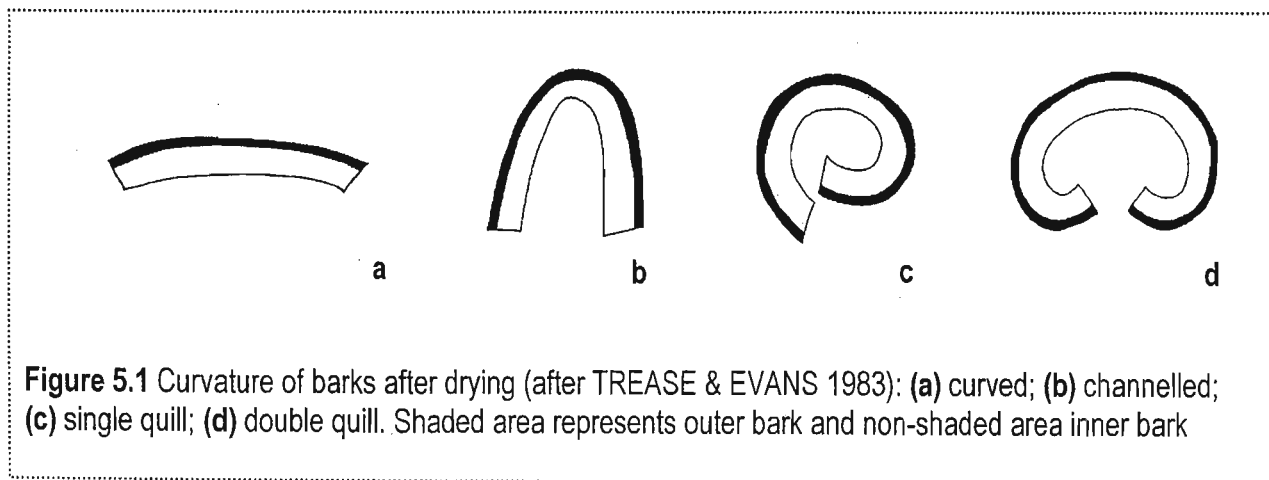
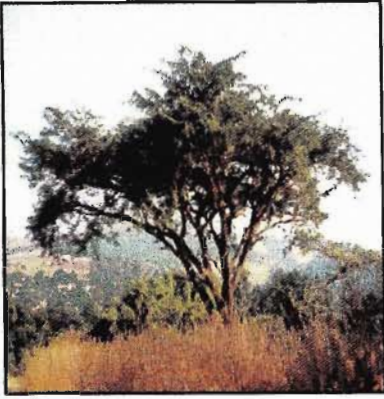


Figure 5.1 Curvature of barks after drying (after TREASE & EVANS 1983): (a) curved; (b) channelled; (c) single quill; (d) double quill. Shaded area represents outer bark and non-shaded area inner bark

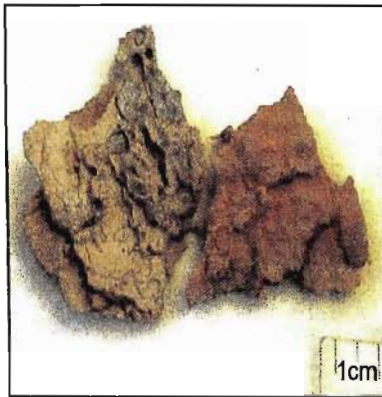
Dried material was stored in sealed containers at room temperature in darkness. Voucher specimens were deposited in the Bews Herbarium at the University of Natal, Pietermaritzburg (voucher numbers are listed in Tables 5.2 and 5.3). Descriptive data collected for reference specimens and dried medicinal bark products were compiled to characterise each species' bark (Plates 5.1-5.8).



Acacia sieberiana in the field



Fresh bark



Dried bark



Bark medicine

Plate 5.1

Acacia sieberiana DC.

MIMOSACEAE

Fresh reference description

OUTER SURFACE Bark flaking in one to many layers; inner layers pale yellow with fine powder, flaking outer layers pale grey and silvery, yellow to yellow-brown or pink-brown; velvet textured to smooth with fine horizontal striations. Inconspicuous lenticels. Small patches of lower plants may be present.

INNER SURFACE Inner surface of peeling outer rhytidome dark yellow to orange-brown, becoming increasingly dark; velvet textured with horizontal striations. Underlying wood deep pink marbled red to dark brown on drying.

FRACTURE Flakes brittle and granular, large pieces fibrous.

ODOUR & TASTE No distinctive odour. Taste bitter.

CURVATURE AFTER DRYING Flaking rhytidome showed no change on drying, inner bark curved.

MILLED MATERIAL Pale yellow-brown; fine powder.

Dried medicinal bark products

OUTER SURFACE Flaking in large, spongy and multi-layered pieces; pale yellow to grey-yellow or yellow-brown; velvet-textured.

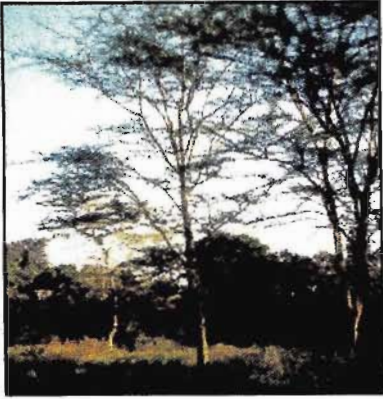
INNER SURFACE Inner surface pale yellow to red-brown or dark brown; smooth. Underlying wood pale yellow, almost white; fibrous.

FRACTURE Fibrous.

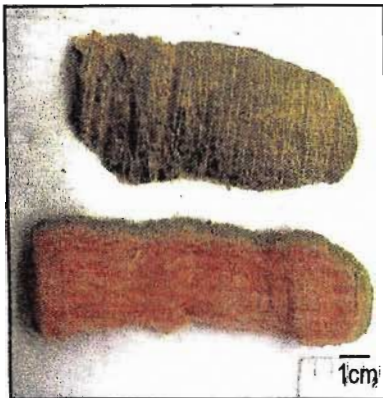
ODOUR & TASTE No distinctive odour. Taste somewhat bitter.

CURVATURE AFTER DRYING Curved or single quill.

MILLED MATERIAL Cream-coloured; fibrous with fine powder.



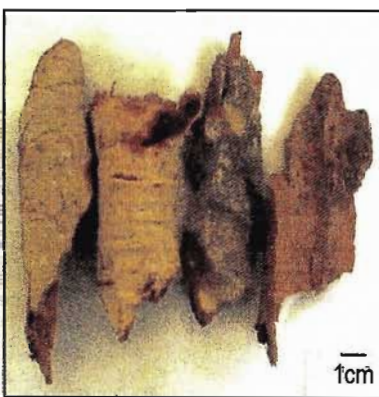
Acacia xanthophloea in the field



Fresh bark



Dried bark



Bark medicine

Plate 5.2

Acacia xanthophloea Benth.

MIMOSACEAE

Fresh reference description

OUTER SURFACE Bright green in immature material, mature material pale yellow-brown after scraping; smooth with fine vertical fissures, or wrinkled horizontally and resembling skin. Sometimes with scattered lenticel scars. Always covered in fine pale yellow to yellow-brown powder. Occasionally lower plants may be present.

INNER SURFACE Bright green, yellow-green to pale yellow-brown and darker in mature material; smooth. Underlying wood pale to deep pink-red, distinctly marbled white.

FRACTURE Fibrous or granular.

ODOUR & TASTE Odour of mature material similar to maize meal. Powder may cause sneezing.

CURVATURE AFTER DRYING Curved to channelled, double quill in the case of thin pieces.

MILLED MATERIAL Pale yellow to pink-brown; fibrous with fine powder.

Dried medicinal bark products

OUTER SURFACE Pale yellow to yellow green or darker and grey-green; smooth, resembling skin. Scattered lenticel scars. Yellow powder remaining in some places.

INNER SURFACE Inner bark pale red-brown. Underlying wood deep red-brown.

FRACTURE Unknown.

ODOUR & TASTE None distinctive.

CURVATURE AFTER DRYING Curved.

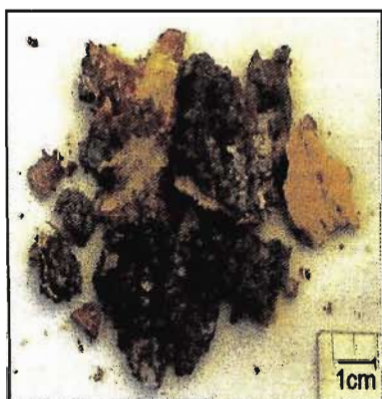
MILLED MATERIAL Pale pink-brown; powder with fibrous chips.



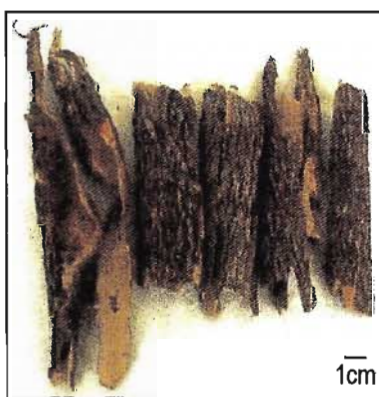
Albizia adianthifolia in the field



Fresh bark



Dried bark



Bark medicine

Plate 5.3

Albizia adianthifolia (Schumach.) W. Wight

MIMOSACEAE

Fresh reference description

OUTER SURFACE Grey to dark brown and red-brown after scraping, younger branches with fine brown velvety pubescence; corky and makes distinctive high-pitched noise against a blade when harvested, smooth but with vertical fissures becoming increasingly deep. White lenticel markings. Lower plants may be present.

INNER SURFACE Red-brown. Underlying wood yellow to orange.

FRACTURE Granular, crumbling on harvesting.

ODOUR & TASTE Mildly astringent taste.

CURVATURE AFTER DRYING Curved.

MILLED MATERIAL Dark red-brown; granular or fine powder, with much yellow fibrous material.

Dried medicinal bark products

OUTER SURFACE Mottled grey, dark brown to black; corky, smooth or with shallow vertical fissures. Marked with lenticel scars.

INNER SURFACE Red-brown. Underlying wood yellow- to red-brown.

FRACTURE Granular to fibrous.

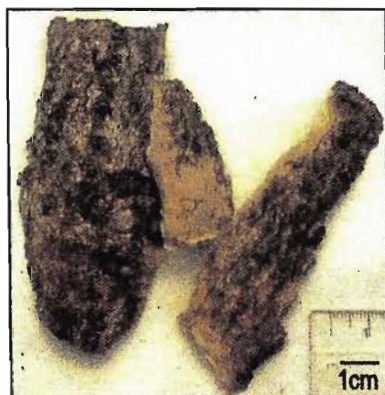
ODOUR & TASTE None distinctive.

CURVATURE AFTER DRYING Curved to channelled.

MILLED MATERIAL Pale yellow-brown to pink-brown or dark red-brown; fine powder.



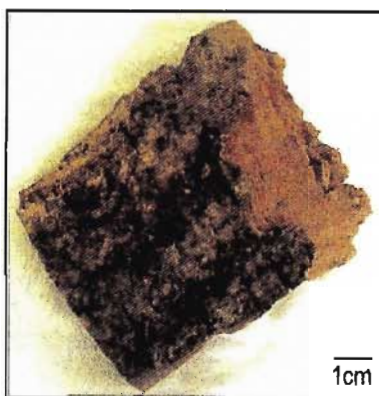
Croton sylvaticus in the field



Fresh bark



Dried bark



Bark medicine

Plate 5.4

Croton sylvaticus Hochst.

EUPHORBIACEAE

Fresh reference description

OUTER SURFACE Silver grey, yellow to dark grey-brown after scraping; fine longitudinal fissures. Raised lenticels on young material. Lower plants may be present.

INNER SURFACE Pale brown; smooth, waxy. Underlying wood pale yellow to yellow-brown with darker vertical pattern.

FRACTURE Granular.

ODOUR & TASTE Strong and persistent odour of black pepper. Somewhat sweet taste.

CURVATURE AFTER DRYING Curved to channelled.

MILLED MATERIAL Yellow to brown; fine powder with strong odour of black pepper.

Dried medicinal bark products

OUTER SURFACE Pale grey or yellow with yellow to brown mottled or vertical markings; smooth or roughly fissured. Lower plants may be present.

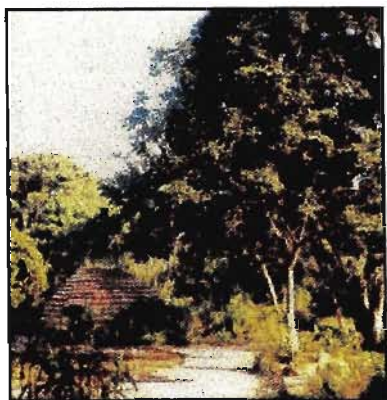
INNER SURFACE Yellow-brown. Underlying wood pale yellow.

FRACTURE Granular.

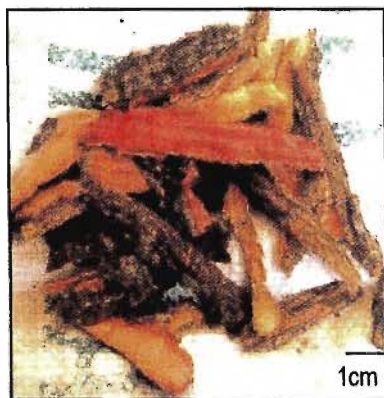
ODOUR & TASTE Mild fragrance of black pepper. Slightly bitter taste.

CURVATURE AFTER DRYING Double quill.

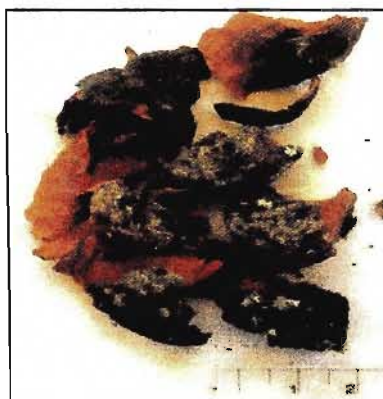
MILLED MATERIAL Pale yellow to pale pink-brown; fine powder with strong odour of black pepper.



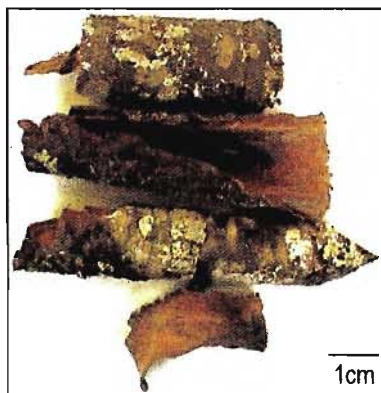
Ekebergia capensis in the field



Fresh bark



Dried bark



Bark medicine

Plate 5.5

Ekebergia capensis Sparrm.

MELIACEAE

Fresh reference description

OUTER SURFACE Grey to brown; smooth with sheen, fissured vertically and broken in rectangular pattern. Branches marked with white lenticels. Lower plants may be present.

INNER SURFACE Yellow-green or darker, becoming pale brown with dark pink underlying layer; smooth and waxy. Underlying wood pale to dark pink, marbled white.

FRACTURE Granular.

ODOUR & TASTE Mild odour resembling castor oil. Astringent taste.

CURVATURE AFTER DRYING Channelled to single or double quill.

MILLED MATERIAL Pink-brown; powder with fibres.

Dried medicinal bark products

OUTER SURFACE Dark grey to brown; smooth with shallow vertical fissures, becoming rough. Lower plants may be present.

INNER SURFACE Pale yellow-brown or darker; smooth. Underlying wood yellow-brown to dark red-brown; fibrous yet smooth.

FRACTURE Granular.

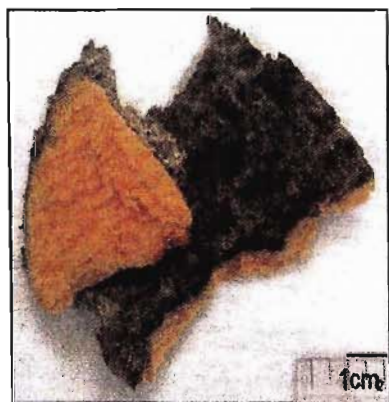
ODOUR & TASTE No distinctive odour. Mildly astringent taste.

CURVATURE AFTER DRYING Channelled to single or double quill.

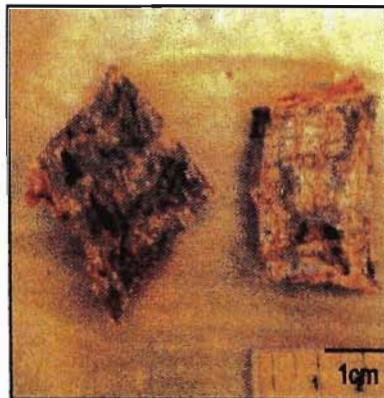
MILLED MATERIAL Pink-brown; very fine powder.



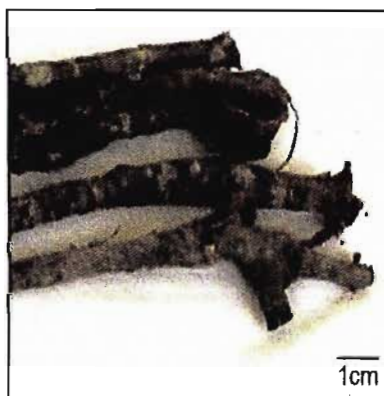
Harpephyllum caffrum in the field



Fresh bark



Dried bark



Bark medicine

Plate 5.6

Harpephyllum caffrum Bernh. ex Krauss

ANACARDIACEAE

Fresh reference description

OUTER SURFACE Grey to grey-brown, pale brown after scraping; smooth, glossy, with vertical fissures. Prominent lenticel scars. Lower plants may be present.

INNER SURFACE Grey-green to brown; smooth, waxy. Underlying wood pink, marbled white.

FRACTURE Granular.

ODOUR & TASTE Odour sweet, resembling sugar cane. Astringent taste.

CURVATURE AFTER DRYING Curved.

MILLED MATERIAL Pink to red-brown; powder with fibres.

Dried medicinal bark products

OUTER SURFACE Grey to grey-brown; smooth with vertical fissures, becoming rough. Lower plants may be present.

INNER SURFACE Dark yellow, pink-brown to brown. Underlying wood red-brown.

FRACTURE Unknown.

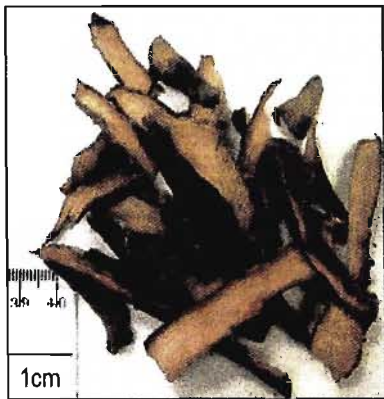
ODOUR & TASTE No distinctive odour. Mildly astringent taste.

CURVATURE AFTER DRYING Double quill.

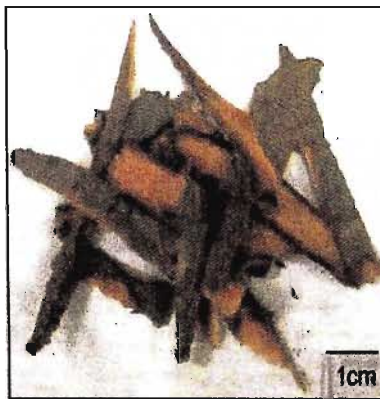
MILLED MATERIAL Pale pink to pink-brown; powder with fibres.



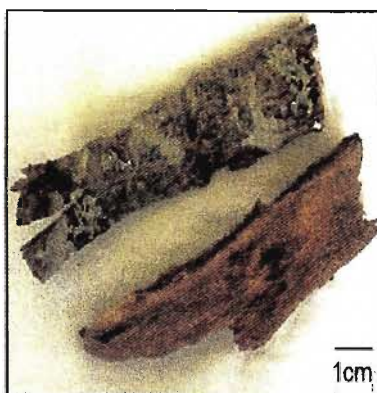
Rapanea melanophloeos in the field



Fresh bark



Dried bark



Bark medicine

Plate 5.7

Rapanea melanophloeos (L.) Mez

MYRSINACEAE

Fresh reference description

OUTER SURFACE Grey to grey-brown, sometimes mottled; immature bark smooth with waxy sheen, becoming rough and flaking with maturity. Orange-brown lenticel scars up to 3 mm in diameter.

INNER SURFACE Dark yellow- to red-brown; smooth with vertical markings. Underlying wood pale pink to yellow.

FRACTURE Fibrous.

ODOUR & TASTE No distinctive odour. Strong astringent tannin taste.

CURVATURE AFTER DRYING Curved to double quill.

MILLED MATERIAL Dark pink-brown; powder with grey flakes.

Dried medicinal bark products

OUTER SURFACE Grey to dark brown; smooth but with rough vertical fissures. Lower plants may be present. (May resemble the bark of *Pinus* sp. (Pinaceae) also used medicinally in KwaZulu-Natal).

INNER SURFACE Dark orange-brown; pitted. Underlying wood pink to yellow-brown; fibrous.

FRACTURE Fibrous.

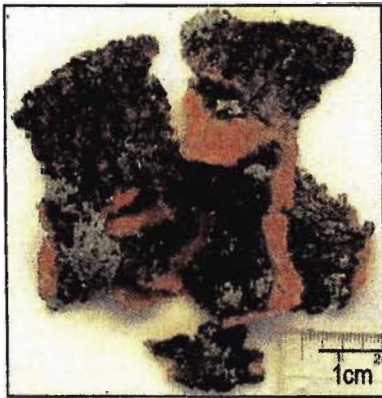
ODOUR & TASTE None distinctive.

CURVATURE AFTER DRYING Curved to single quill.

MILLED MATERIAL Pink to red-brown; powder with fibres.



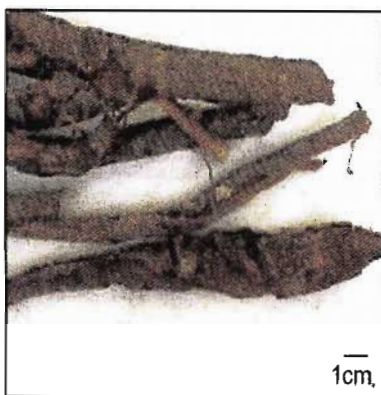
Schotia brachypetala in the field



Fresh bark



Dried bark



Bark medicine

Plate 5.8

Schotia brachypetala Sond.

CAESALPINIACEAE

Fresh reference description

OUTER SURFACE Dark brown, sometimes silvery, pale brown after scraping; smooth with fine longitudinal fissures, becoming roughly fissured and crumbling. May show dark lenticel scars. Lower plants may be present.

INNER SURFACE Pale orange-brown; smooth, waxy. Underlying wood pale yellow to yellow-brown, marbled pink.

FRACTURE Granular.

ODOUR & TASTE No distinctive odour. Bitter, astringent taste.

CURVATURE AFTER DRYING Curved.

MILLED MATERIAL Pink to red-brown; powder with grey fibres.

Dried medicinal bark products

OUTER SURFACE Dark grey to red-brown; smooth with longitudinal fissures becoming broken in rectangular pattern.

INNER SURFACE Pale red-brown; smooth. Underlying wood red-brown; smooth but fibrous.

FRACTURE Granular.

ODOUR & TASTE None distinctive.

CURVATURE AFTER DRYING Curved to double quill.

MILLED MATERIAL Pink to dark red-brown; fine powder, sometimes with fibres.

Results and discussion

Bark characters assessed for each species were congruent between reference samples collected, but less so between medicinal bark products. The latter may be attributable to possibly wide variations in the regions from which bark products originated, as environmental variables strongly impress upon bark morphology (BORGER 1973, JUNIKKA 1994). Varying degrees of similarity were observed between reference specimens and medicinal products; in most cases this was attributable to obvious differences in maturity. Medicinal bark products typically showed extensive rhytidome tissue whereas reference samples were less mature.

The size and thickness of bark products purchased in this study suggested alarming impacts upon indigenous vegetation. Plant gatherers favour the thick bark of oldest individuals for greater economic returns (CUNNINGHAM 1991) and therefore the size of plant parts traded is a useful indicator of species availability (BOTHA *et al.* 2001). Thickness of rhytidome and dimensions of bark products clearly indicate the maturity of trees from which they are sourced. On several occasions during this study, the shop attendant cut slices from a larger piece of bark (up to ca. 10 x 50 cm with rhytidome of up to 2 cm) using an axe.

Declining sizes of medicinal plant products may indicate that large individuals are no longer available, or that insufficient regeneration time is allowed between harvesting episodes (BOTHA *et al.* 2001). For example, WILLIAMS (1996) noted that on the Witwatersrand, *Ocotea bullata* (Bertol. f.) Chiov. bark products harvested in KwaZulu-Natal and Swaziland were typically 1-3 mm thick and 5 cm long, until more mature trees were found in the Transkei region (Eastern Cape), when bark products increased to 6 mm in thickness. Algae, moss and lichen growing on several bark products purported to be *C. sylvaticus*, *E. capensis* and *H. caffrum* indicated that the trees from which bark was harvested occurred in (undisturbed) closed-canopy forests (CUNNINGHAM 1988, WILLIAMS 1996, MANDER *et al.* 1997). The volume of attached wood on bark products further suggested that harvesting resulted in severe injury or death of trees, as translocation in the secondary phloem would have been extensively interrupted.

Economic data pertaining to the trade of bark products from *A. sieberiana*, *A. adianthifolia*, *C. sylvaticus*, *E. capensis* and *H. caffrum* are absent in the literature (Chapter 3), although *A. adianthifolia* and *E. capensis* are considered to be in high demand (CUNNINGHAM 1988, MANDER 1998, WILLIAMS *et al.* 2000). CUNNINGHAM (1988) reported that a 50 kg-sized bag of *A. xanthophloea*, *R. melanophloeos* or *S. brachypetala* bark was traded for R 10 at Isipingo medicinal plant market in KwaZulu-Natal. More recently, BOTHA *et al.* (2001) reported that *R. melanophloeos* bark cost R 33-83/kg in Mpumalanga Province. In this study, the price of medicinal bark products purported to be the eight study species compared closely

between the three herbalist retailers visited. Products cost R3.00, R 3.50, R 5.50 or R 5.60 for one or several bark pieces amounting to 75-150 g (R 30-56/kg).

The literature reflects a high degree of synonymy in vernacular nomenclature (Chapter 3) applied to seven of the eight study species considered here; *H. caffrum* is known only as 'umgwenya'. Although several vernacular names are recorded in the literature for *A. sieberiana* (four Zulu names), *C. sylvaticus* (11), *E. capensis* (13) and *S. brachypetala* (5), bark products purportedly of these species were recognised by shop attendants by a single Zulu name. Three and seven vernacular names are recorded in the literature for *A. adianthifolia* and *A. xanthophloea* respectively, and shop attendants recognised both species by two Zulu names. Nine names are recorded for *R. melanophloeos*, of which three were recognised by shop attendants. Although bark products purported to be these species were purchased by different vernacular names, the products appeared similar and were indeed likely to be the same species.

However, in the case of *A. xanthophloea*, one unusual product ('umdllovune') resembled a smooth piece of furniture wood! Also interesting was the purchase (without aid of a photograph) of 'umzilanyoni', a Zulu name recorded for *C. sylvaticus*, from two shops; the plant products supplied were in fact seedpods from the exotic *Cassia javanica* L. (Leguminosae). The latter illustrates the importance of geographic data to qualify vernacular nomenclature and other information recorded in the literature. In their key to some medicinal plant products traded in KwaZulu-Natal, TAIT & CUNNINGHAM (1988) provided a common Zulu vernacular name, and in some cases up to five synonyms that referred explicitly to nomenclature used in local markets.

Characterisation of reference specimens and medicinal products purportedly of the same species indicated that freshly harvested bark is more readily identifiable than dried bark, but that some diagnostic characters persist in dried bark and may prove useful for identification. For instance, *C. sylvaticus* bark is recognisable by typically pale colouring and aroma of black pepper. The flaking rhytidome of *A. sieberiana*, and the pale yellow-green, powdery bark of *A. xanthophloea* are sufficiently distinctive to allow ready identification of medicinal bark products. Some characters considered important in the study species here were not detailed by TAIT & CUNNINGHAM (1988), for example the presence of horizontal 'wrinkles' in *A. xanthophloea* bark that impart a resemblance to skin, and the high-pitched sound made by a blade through the corky bark of *A. adianthifolia*. In the same key, there was no mention of commonly confused barks, such as *E. capensis* and *H. caffrum*, or usage patterns where species may be substituted for others. Documentation of characters typical of medicinal bark medicines used in KwaZulu-Natal, as well as characters that separate commonly confused barks, would aid the identification and authentication thereof.

An investigation into the application of Thin Layer Chromatography for authentication of some bark products used medicinally in KwaZulu-Natal, South Africa

Introduction

In South Africa, where most traditional medicines are of plant origin, regulation of their trade and usage is minimal. Standardisation of traditional herbal medicines would be a significant step towards securing the integrity of the traditional healthcare sector, and the safety of its patients, who comprise the majority of South Africans (MANDER 1998). Unlike the established pharmacopoeias of herbal medicines in other parts of the world (e.g. China, Europe, India), the repertoire of herbal medicines used in this country is poorly documented. The first monographs for a South African pharmacopoeia were commissioned only in 1997 (SATMERG 2000).

Chemical 'fingerprints' obtained by chromatography are a convenient and reliable method to verify the identity and quality of plant material sold in markets (MANANA & ELOFF 2001). Despite the development of advanced chromatographic techniques for the elucidation of compounds from natural products, Thin Layer Chromatography (TLC) remains effective and favoured for its simplicity and affordability (KIRCHNER 1967, GIBBONS & GRAY 1998). Terminology implies that phytochemical 'fingerprints' are unique, but in the absence of fingerprints of all plant species, this cannot be guaranteed. However, due to the diagnostic value of TLC-generated fingerprints, the technique has largely replaced microscopy in plant drug authentication and quality assessment (JACKSON & SNOWDON 1990).

Dried plant products sold in the medicinal plant trade in South Africa are generally very difficult to identify, as many useful morphological characters are lost through desiccation (Chapters 4 and 5). In particular, many bark products lack distinctive diagnostic characters and appear superficially similar; inadvertent misidentification or purposeful substitution are perhaps more likely to affect the appropriate use of barks than other herbal medicines. The single existing guide to some commonly traded bark products in KwaZulu-Natal is that of TAIT & CUNNINGHAM (1988). Authentication of traditional herbal medicines traded in KwaZulu-Natal would facilitate accurate documentation of taxa traded and medicinal usage, and assist in identifying material implicated in poisoning cases. Because the province is considered the trade centre for medicinal plants in southern Africa (CUNNINGHAM 1988, MANDER *et al.* 1996, WILLIAMS 1996, MANDER

1998, MARSHALL 1998, WILLIAMS *et al.* 2000), data would be relevant to the monitoring of regional, national and international markets.

TLC-generated phytochemical fingerprints were investigated for their potential to distinguish between the bark of eight medicinal species used in KwaZulu-Natal (Plates 5.1-5.8, Chapter 5). According to a local traditional healer, Mr Elliot Ndlovu, the species are frequently misidentified and/or substituted for other bark products by traditional healers and medicinal plant traders in the province. The study aimed to establish fingerprint references for each species, against which medicinal bark products purportedly of the same species could be authenticated. It should be noted that authentication refers to the confirmation of an identity, whilst identification is explicit. To this effect, a 'real-life' scenario was used to test the hypotheses that bark fingerprints of different taxa are unlike, and that the fingerprint of a bark product will closely resemble that of a provenanced reference.

Methodology

Plant material

Eight study species were grouped in two 'complexes' (Table 6.1) according to the patterns of substitution or misidentification that affect their usage (Chapter 5). Reference bark specimens and medicinal bark products purportedly of each species (detailed in Chapter 5) were subjected to TLC investigation.

Plant extracts

Dried plant material was milled to a powder and extracted with ethanol or hexane, in a ratio of 1 g milled material:10 ml solvent. Plant material and solvent was macerated in an ultrasound bath (Branson 1510E-MT) for 60 min, filtered through filter paper (Whatman No. 1) with a Buchner funnel under vacuum, and air-dried. Preparation of extracts conformed to the general requirement that extraction procedures be fast yet efficient (WAGNER & BLADT 1995). If necessary, residues in airtight glass vials were refrigerated (15 °C) in darkness prior to experimental procedures, to prevent microbial contamination and degradation of photosensitive compounds. Residues were weighed and dissolved in the extractant solvent to yield extracts of 50 mgml⁻¹ concentration.

Table 6.1 Study species and grouping in species complexes according to medicinal usage patterns

	Family	Taxon	Taxa with which bark products are confused
Species complex 1	MELIACEAE	<i>Ekebergia capensis</i>	<i>Harpephyllum caffrum</i> ; <i>Schotia brachypetala</i>
	ANACARDIACEAE	<i>Harpephyllum caffrum</i>	<i>Ekebergia capensis</i> ; <i>Rapanea melanophloeos</i>
	MYRSINACEAE	<i>Rapanea melanophloeos</i>	<i>Harpephyllum caffrum</i>
	FABACEAE – CAESALPINIACEAE	<i>Schotia brachypetala</i>	<i>Ekebergia capensis</i>
Species complex 2	FABACEAE - MIMOSACEAE	<i>Acacia sieberiana</i>	<i>Albizia adianthifolia</i> ; <i>Croton sylvaticus</i>
	FABACEAE – MIMOSACEAE	<i>Acacia xanthophloea</i>	<i>Croton sylvaticus</i>
	FABACEAE - MIMOSACEAE	<i>Albizia adianthifolia</i>	<i>Acacia sieberiana</i> ; <i>Croton sylvaticus</i>
	EUPHORBIACEAE	<i>Croton sylvaticus</i>	<i>Acacia sieberiana</i> ; <i>Acacia xanthophloea</i> ; <i>Albizia adianthifolia</i>

Thin Layer Chromatography

TLC analysis of plant extracts was with a stationary phase of silica gel on pre-coated plastic sheets (Merck 60 F₂₅₄). Sufficient extract to yield 0.5 mg plant material was applied in 0.8 cm or 1 cm bands to the origin of the chromatography plate. Glass chromatography chambers were pre-washed with the mobile phase and allowed to equilibrate for approximately 2 min. Plates were placed in the tank and run over a migratory distance of 8 cm. Twelve mobile phases were tested before a solvent system comprising petroleum spirit¹: ethyl acetate: chloroform: formic acid (8:7:5:1) was selected as suitable for further analyses of both ethanol and hexane bark extracts.

Chromatograms were viewed in visible and UV light (254 nm and 366 nm) prior to treatment with a developing reagent. Anisaldehyde-sulphuric acid reagent (WAGNER & BLADT 1995) and vanillin-sulphuric acid reagent (WAGNER & BLADT 1995), both of which allow detection of a variety of colourless chemical compounds when heated, were tested and selected for further analyses. Sprayed chromatograms were similarly viewed in visible and UV light.

Intraspecific and interspecific fingerprints

Initially, ethanol and hexane extracts of one 'trial' specimen (usually that of which the most material was available) of each study species was used to establish the solvent system and spray reagent used in

¹ 95 % fraction, boiling interval 60-80 °C.

further experiments. Thereafter ethanol and hexane extracts of three bark specimens of each study species were submitted to the above TLC procedure and the intraspecific fingerprints compared. Interspecific fingerprints obtained in the same way were compared between the species in each complex (Table 6.2).

Table 6.2 Study species and specimens subjected to TLC: collection localities and chromatogram lane references

Study species	Collection locality in KwaZulu-Natal	Chromatogram lane reference
<i>Ekerbegia capensis</i>	National Botanical Gardens, Pietermaritzburg	1
	Krantzkloof Nature Reserve, Kloof	2
	Silverglen Nature Reserve, Chatsworth	3
<i>Harpephyllum caffrum</i>	National Botanical Gardens, Pietermaritzburg	4
	Silverglen Nature Reserve, Chatsworth	5
	University of Natal Botanic Gardens, Pietermaritzburg	6
<i>Rapanea melanophloeos</i>	National Botanical Gardens, Pietermaritzburg	7
	Krantzkloof Nature Reserve, Kloof	8
	Silverglen Nature Reserve, Chatsworth	9
<i>Schotia brachypetala</i>	National Botanical Gardens, Pietermaritzburg	10
	Krantzkloof Nature Reserve, Kloof	11
	University of Natal Botanic Gardens, Pietermaritzburg	12
<i>Acacia sieberiana</i>	National Botanical Gardens, Pietermaritzburg	13
	Krantzkloof Nature Reserve, Kloof	14
	Silverglen Nature Reserve, Chatsworth	15
<i>Acacia xanthophloea</i>	National Botanical Gardens, Pietermaritzburg	16
	University of Natal Agricultural Campus, Pietermaritzburg	17
	University of Natal Botanic Gardens, Pietermaritzburg	18
	Institute of Natural Resources, Scottsville	19
	Durban Road shopping centre, Scottsville	20
<i>Albizia adianthifolia</i>	University of Natal Main Campus, Pietermaritzburg	21
	Cascades Farm, Waterfall	22
	Krantzkloof Nature Reserve, Kloof	23
	Silverglen Nature Reserve, Chatsworth	24
<i>Croton sylvaticus</i>	National Botanical Gardens, Pietermaritzburg	25
	Krantzkloof Nature Reserve, Kloof	26
	University of Natal Botanic Gardens, Pietermaritzburg	27

Authentication of medicinal bark products

Hexane extracts of one reference specimen (selected according to fingerprints yielded in earlier analyses) and three medicinal bark products of each species were run in the system described above and the fingerprints compared (Table 6.3).

Table 6.3 Medicinal bark products subjected to TLC authentication: purported species identities, Zulu vernacular names and chromatogram lane references

Purported species	Zulu vernacular name	Chromatogram lane reference
<i>Ekebergia capensis</i>	<i>isimanaye</i>	28
		29
		30
<i>Harpephyllum caffrum</i>	<i>umgwenya</i>	31
		32
		33
<i>Rapanea melanophloeos</i>	<i>ikhubalwane</i>	34
	<i>isicalaba</i>	35
	<i>maphipha</i>	36
<i>Schotia brachypetala</i>	<i>ihlusi</i>	37
		38
		39
<i>Acacia sieberiana</i>	<i>umkhamba</i>	40
		41
		42
<i>Acacia xanthophloea</i>	<i>umdlovune</i>	43
	<i>umkhanyagude</i>	44
		45
<i>Albizia adianthifolia</i>	<i>igowane</i>	46
	<i>umgadankawu</i>	47
		48
<i>Croton sylvaticus</i>	<i>amahlabekufeni</i>	49
		50
		51

Results and discussion

Thin Layer Chromatography

Repeatability is critical in developing a TLC system for plant drug authentication. The technique has been extensively discussed (KIRCHNER 1967, STAHL 1969, JORK *et al.* 1990, WAGNER & BLADT 1995, GIBBONS & GRAY 1998) and the experimental factors on which repeatability depends identified as the stationary and mobile phases, and methods of compound detection. Reproducible TLC separations can be

achieved only if a standardised stationary phase, such as commercially available plates, is used (JORK *et al.* 1990, WAGNER & BLADT 1995). Since silica gel is an efficient adsorbent for the separation of most drug extracts, the use of plastic-backed silica TLC plates in this study ensured standardised analyses. The mobile phase should be uncomplicated in composition, possess minimal temperature sensitivity, and give exact and sufficient separation of constituents for drug characterisation (WAGNER & BLADT 1995).

In their comparison of *Maytenus* spp. (Celastraceae), ROGERS *et al.* (2000) noted that some species yielded a sufficiently diagnostic phytochemical fingerprint from only one chromatogram, whilst several solvent systems were required to diagnose other species. The use of more than one solvent system facilitates comparison of different extracts of one species (GIBBONS & GRAY 1998). MANANA & ELOFF (2001) used three solvent systems in their investigation of traditional plant medicines traded in Pretoria, South Africa. This was to allow effective separation of extracts of differing polarities, in non-polar, intermediate and polar systems.

In this case, ethanol and hexane extracts, expected to contain more polar and non-polar compounds respectively, showed comparable separation in a single mobile phase. Although not particularly simple, it yielded consistently good separations of hexane extracts, and acceptable separation of ethanol extracts, of each species. Therefore a single solvent system was deemed satisfactory for the separation of both extract types. Ethanol and hexane extracts were fingerprinted for intraspecific and interspecific comparisons, but since the latter separated into more bands and yielded more meaningful fingerprints, hexane extracts alone were employed to authenticate medicinal bark products.

Also important in TLC analysis of medicinal plants, crude drugs and extracts, is the reagent with which a chromatogram is visualised (RIOS *et al.* 1986). Detection is best achieved when certain compounds are exploited for their striking colours, even if they are neither the characteristic nor active compounds of the drug, as they provide an easy visual method of identification (STAHL & SCHORN 1969, WAGNER & BLADT 1995). Prior to development, most plates in this study showed few bands in visible light, but many quenching (UV 254 nm) and fluorescent (UV 366 nm) bands when viewed under a UV lamp. Whilst UV visualisation represents a non-destructive method of detection for compounds that show quenching or fluorescence, it is unsuitable for those that do not absorb UV wavelengths (GIBBONS & GRAY 1998). Both anisaldehyde- and vanillin-sulphuric acid reagents substantially increased detection and visualisation of compounds on the chromatograms in this study; detection was superior in species complex 1 following development with anisaldehyde-sulphuric acid reagent (Figures 6.1 and 6.2), and in complex 2 with vanillin-sulphuric acid reagent (Figures 6.3 and 6.4). The most diagnostically important information in TLC analyses such as this

are colouration and R_f values of compound bands, which together provide the fingerprint of a particular species (ROGERS *et al.* 2000).

Intraspecific and interspecific fingerprints

Surprisingly, a high degree of consistency was usually evident between phytochemical fingerprints at the intraspecific level. Despite differing habitats, maturity, and other variables known to influence bark characteristics, fingerprints of three bark specimens compared closely for study species in complex 1 (Figures 6.5 and 6.6) and complex 2 (Figures 6.7 and 6.8). *Acacia xanthophloea* was the single species to show incongruent fingerprints among three specimens.

Consequently, three additional bark specimens of *A. xanthophloea* were collected and fingerprints of the six specimens compared (Figures 6.9 and 6.10). They were sufficiently consistent to indicate a shared taxon. It is postulated that the abundance of characteristic yellow powder on the bark may be responsible for observed differences in fingerprints; this may be resolved through further phytochemical analyses.

At the interspecific level, three out of four species in complex 1 were readily distinguishable by their phytochemical fingerprint (Figures 6.5 and Figure 6.6). Hexane extracts of *Ekebergia capensis*, *Harpephyllum caffrum* and *Schotia brachypetala* yielded fingerprints that were readily separable after development with anisaldehyde. Similarities were noted in *E. capensis* and *H. caffrum* in the R_f range 0.1-0.5, but distinctive compound bands occurred between R_f 0.5 and R_f 0.9. A distinctive band at R_f 0.7 was noted in *S. brachypetala* hexane fingerprints. *Rapanea melanophloeos* fingerprints failed to show diagnostic compound bands unique to that species; this presented a problem in determining a reliable reference against which medicinal bark products could be authenticated.

Whereas interspecific differences were pronounced in species complex 1, three species in complex 2 failed to show diagnostic compounds at that level (Figures 6.7 and 6.8). Ethanol extracts separated poorly and compound bands spread after development (Figure 6.7 (c)) but chromatograms of hexane extracts were unaffected. However, fingerprints of *A. xanthophloea*, *Albizia adianthifolia* and *Croton sylvaticus* were not differentiable from one another. *Acacia sieberiana* was distinguishable by a pale pink band in both ethanol and hexane extracts at R_f 0.9 on undeveloped chromatograms (see Figure 6.11 (a)).

Diagnostic phytochemical fingerprints correspond with existing taxonomic trends in plant genera such as *Combretum* (Combretaceae) (CARR & ROGERS 1987) and *Maytenus* (Celastraceae) (ROGERS *et al.* 2000). DREWES *et al.* (1998) reported chemical similarities, identified by preparative chromatography and

spectroscopy, in the barks of *Loxostylis alata* Spreng. f. Reichb. and *Smodingium argutum* E. Meyer ex Sonder, two members of the Anacardiaceae. Since three of the species considered here belong to the same family (Mimosaceae), similarities in the phytochemical fingerprints may be attributed to their chemotaxonomic relationship.

In an attempt to distinguish between species in complex 2, Dragendorff reagent (WAGNER & BLADT 1995) was employed to detect nitrogen-containing compounds but failed to assist in discriminating between the four species (Figure 6.11). Indeed, the diagnostic band (R_f 0.9) identified in *A. sieberiana* in earlier analyses was the single one to show a bright orange colour reaction with the reagent; this may indicate an alkaloid principle. Since the bark of *A. adianthifolia* is known to contain saponins (VAN WYK *et al.* 1997), the use of saponin-detecting reagents was considered. However, vanillin-sulphuric acid reagent is used for the same purpose (WAGNER & BLADT 1995) and fingerprints of *A. adianthifolia* were nonetheless indistinguishable from the remaining two species (*A. xanthophloea* and *C. sylvaticus*); this raises the possibility that saponins are ubiquitous in this species complex. Other reagents could have been tested for detection of specific phytochemicals, but the literature does not report on compound groups typical of these species' bark. Additionally, developing reagents would need to comply with the principal here of establishing a simple and repeatable methodology for TLC authentication.

Pairs of bark species used interchangeably or as substitutes (purposefully or not) usually shared some compound bands in their respective fingerprints. For example, both *E. capensis* and *H. caffrum* showed a number of pink and orange compounds at R_f 0.1-0.5 that were not present in other members of complex 1. In complex 2, notable similarities in interspecific fingerprints may be an indicator of close usage relationships. The phytochemical similarities shown by TLC chromatograms may indeed explain the phytochemical properties common to bark products that are substituted for one another, particularly in cases where unrelated species are used.

Authentication of medicinal bark products

Analyses of intra- and interspecific fingerprint comparisons showed that a species-specific chemical profile is predictable, although differences between each species' profile may not be readily noticeable using a single TLC system. Despite this shortfall, a 'real-life' scenario was simulated in which the fingerprints of medicinal bark products were compared against that of a reference specimen to test the possibility of authentication using TLC. Co-chromatography of a standard reference with the test extract(s) is necessary to afford accurate comparison of qualitative data (STAHL & SCHORN 1969). Following earlier results, hexane extracts were employed and detection was with anisaldehyde-sulphuric acid reagent for species in complex

1 and vanillin-sulphuric acid reagent for complex 2. Whereas ethanol extracts of reference material were typically light to dark brown and opaque, and hexane extracts bright yellow or green and clear, hexane extracts of medicinal bark products were generally milky white or pale yellow.

The usefulness of TLC for authenticating medicinal plant products may depend largely upon the inherent variability of a plant species: some taxa show highly variable phytochemical properties between populations and chemical races that would require thorough documentation before TLC authentication would be reliable. TLC as a technique whereby bark products may be authenticated was shown to be more reliable than expected, considering the anatomical and morphological variability of bark characters. In their study of medicinal products traded in Pretoria, MANANA & ELOFF (2001) found that phytochemical fingerprints of plant medicines compared well with those of reference material, an encouraging result in the context of this discussion.

In complex 1, *E. capensis* (Figure 6.12), *H. caffrum* (Figure 6.13) and *S. brachypetala* (Figure 6.15) showed convincing similarities between the medicinal and reference specimens. Fingerprints of *R. melanophloeos* (Figure 6.14) specimens showed similarities under UV 366 nm prior to development, but following development, the medicinal lanes bore no resemblance to the reference lane. The observation may correspond to the trend noted in intra- and interspecific analyses, where *R. melanophloeos* failed to show consistent and distinctive fingerprints. Alternatively, since each medicinal product was purchased by a different Zulu vernacular name, the possibility exists that each represents a different species. However, similarities shown by two medicinal products (lanes 34 and 35) between R_f 0.65 and 0.75 suggest a single taxon represented by two vernacular names.

In complex 2, similarities were noted between the reference specimens and respective medicinal lanes of *A. sieberiana* (Figure 6.16), *A. xanthophloea* (Figure 6.17) and *A. adianthifolia* (Figure 6.18). It is unclear if the medicinal bark specimens compared to the *C. sylvaticus* (Figure 6.19) reference were indeed the same species, since each medicinal specimen deviated from the reference differently. There are two reasons why this particular result is somewhat anomalous: a persistent aroma of black pepper, typical of *C. sylvaticus* bark, was noted in all three medicinal specimens, suggestive of a common identity; and the consistent fingerprints yielded in intraspecific analyses of *C. sylvaticus* suggested the chemical profile of this species' bark was notably consistent. Interestingly, MANANA & ELOFF (2002) reported similar problems when comparing the fingerprints of provenanced *C. sylvaticus* bark with medicinal bark products, and further noted that the latter showed poor resemblance to *C. grattissima* too.

In *A. sieberiana*, pink bands were noted in medicinal and reference lanes at R_f 0.9 that fluoresced under UV 366 nm prior to development. Yellow bands (R_f 0.3, 0.5) evident in the medicinal lanes were absent in the reference lane after development, but were evident in the 'trial' lanes of earlier analyses (Figures 6.3 and 6.4). Although medicinal and reference lanes of *A. xanthophloea* and *A. adianthifolia* were similar following development, differences in fluorescence were noted under UV 366 nm.

In the case of *A. xanthophloea*, one medicinal specimen (lane 43) exhibited unusual quenching and fluorescent bands at R_f 0.85 and 0.9 under UV light. It was purchased under a Zulu name different to the other two products, and in fact consisted entirely of wood. The value of TLC for bark authentication may, therefore, be extended to identifying the presence of wood adulterants in bark medicines. Processed bark products may be easily adulterated with wood to increase product volume. Additionally, removal of dried bark from underlying wood is sometimes difficult, and medicinal bark products typically include a large amount of attached wood.

The use of Zulu names recorded in the literature (rather than accurate nomenclature determined through consultation with local Zulu speakers, for example) in purchasing bark products was undertaken purposefully, to determine the local relevance of information in the literature. Data from one region may not necessarily apply to others, but is seldom qualified by geographic data in the literature. Although several Zulu vernacular names were recorded for each study species, it is interesting that bark products of only three were purchased by more than one name (*R. melanophloeos*, *A. xanthophloea* and *A. adianthifolia*). It is apparent that although the literature suggests complex vernacular nomenclature, bark products may be consistently referred to by only one name. Problems associated with the accurate documentation, and reliance on vernacular nomenclature recorded in the literature, were discussed in Chapter 3.

Conclusions

Although this investigation was a rudimentary one, and sampling should be scaled up to accommodate the phytochemical variation expected in plant populations throughout KwaZulu-Natal, several conclusions may be drawn from the present results.

Since bark anatomy and morphology are notoriously variable, phytochemical fingerprints of the bark specimens dealt with here were expected to be irregular. In contrast, however, intraspecific fingerprints obtained were consistent in *E. capensis*, *H. caffrum*, *R. melanophloeos*, *S. brachypetala*, *A. sieberiana*, *A. adianthifolia* and *C. sylvaticus*, but less so in *A. xanthophloea*. Despite consistencies at the intraspecific level, the absence of diagnostic compounds in some species' fingerprints (*Rapanea melanophloeos*, *A.*

xanthophloea, *A. adianthifolia* and *Croton sylvaticus*) reduced their reliability as references against which medicinal bark products may be authenticated. This was emphasised by the 'real-life' authentication experiment, where similarities with the medicinal specimens served to confirm the integrity of some references, rather than the opposite, which should have been the case. Considering the results of this investigation, TLC may indeed fulfil the requirements for a simple, affordable and reliable technique but, for the purpose of definitive bark authentication, should be augmented with by further analyses or other methods.

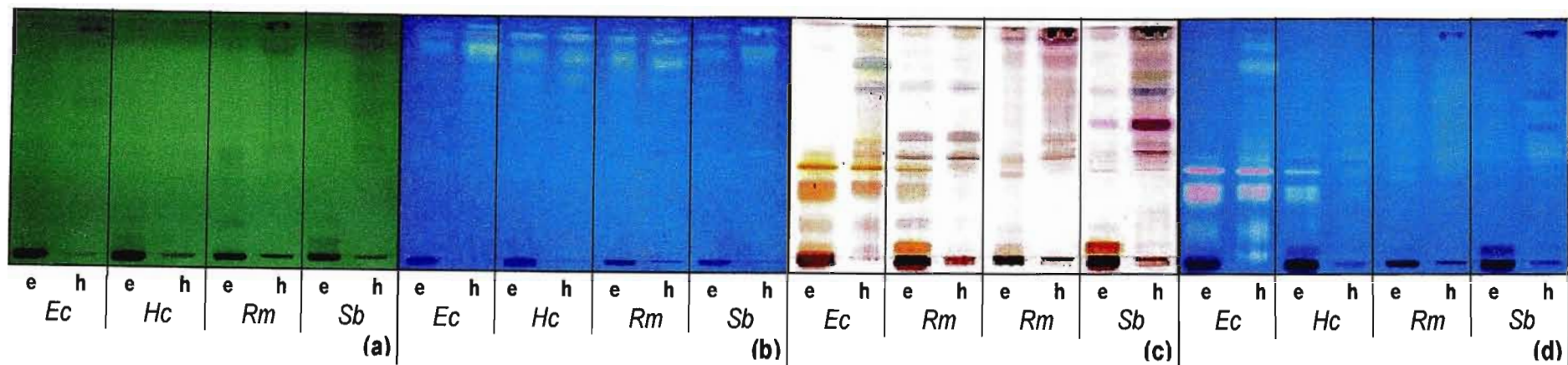


Figure 6.1 Chromatograms from TLC (petroleum spirit:ethyl acetate:chloroform:formic acid 8:7:5:1) of ethanol (e) and hexane (h) bark extracts of 'trial' specimens in species complex 1 (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with anisaldehyde reagent, and (d) under UV 366 nm following development. *Ec* = *Ekebergia capensis*, *Hc* = *Harpephyllum caffrum*, *Rm* = *Rapanea melanophloeos*, *Sb* = *Schotia brachypetala*

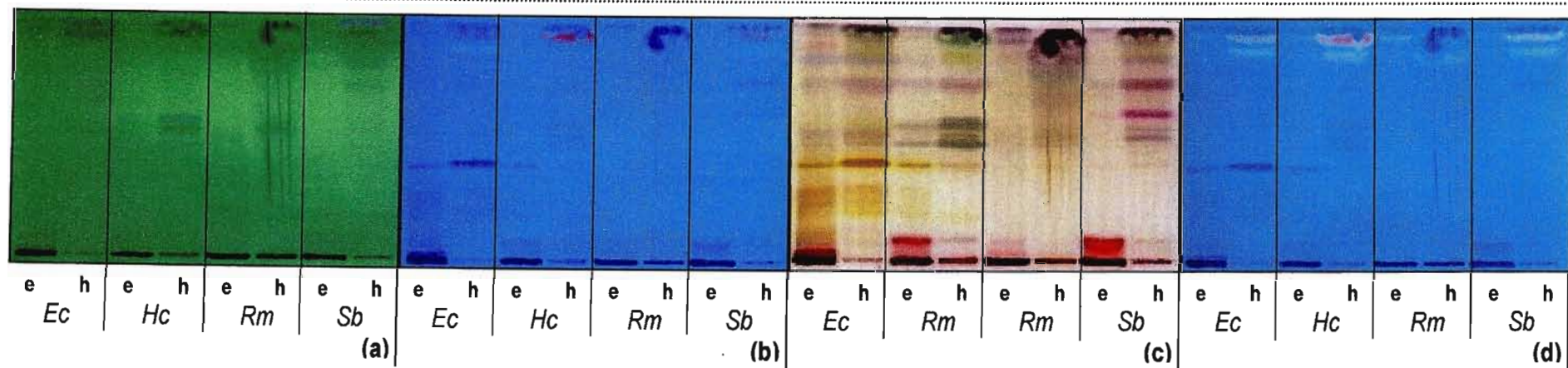


Figure 6.2 Chromatograms from TLC (petroleum spirit:ethyl acetate:chloroform:formic acid 8:7:5:1) of ethanol (e) and hexane (h) bark extracts of 'trial' specimens in species complex 1 (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with vanillin reagent, and (d) under UV 366 nm following development. *Ec* = *Ekebergia capensis*, *Hc* = *Harpephyllum caffrum*, *Rm* = *Rapanea melanophloeos*, *Sb* = *Schotia brachypetala*

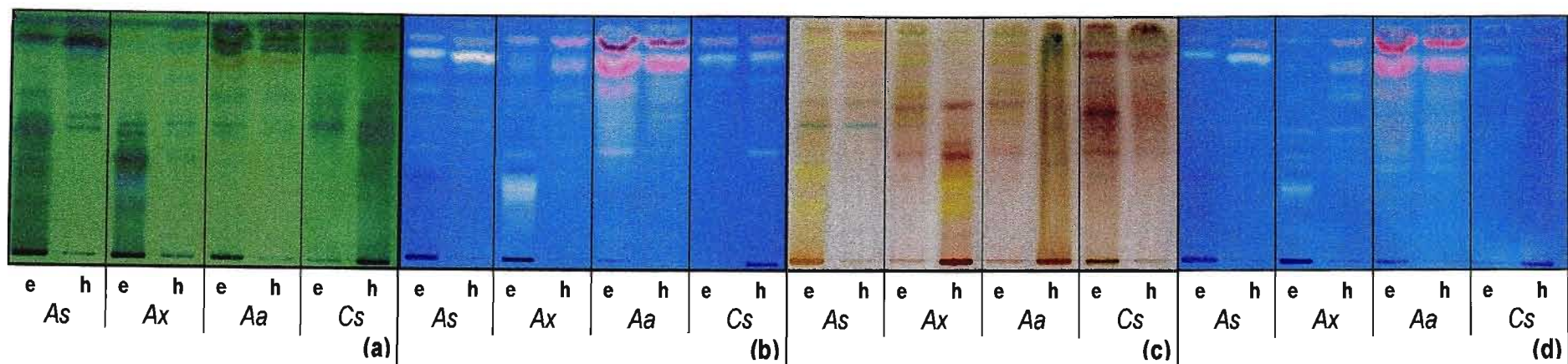


Figure 6.3 Chromatograms from TLC (petroleum spirit:ethyl acetate:chloroform:formic acid 8:7:5:1) of ethanol (e) and hexane (h) bark extracts of 'trial' specimens in species complex 2 (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with anisaldehyde reagent, and (d) under UV 366 nm following development. As = *Acacia sieberiana*, Ax = *Acacia xanthophloea*, Aa = *Albizia adianthifolia*, Cs = *Croton sylvaticus*

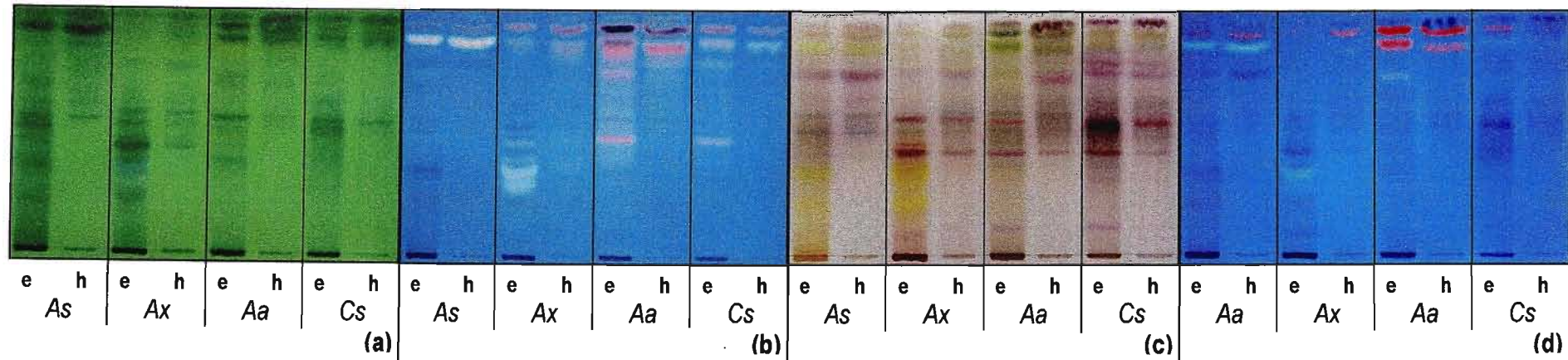


Figure 6.4 Chromatograms from TLC (petroleum spirit:ethyl acetate:chloroform:formic acid 8:7:5:1) of ethanol (e) and hexane (h) bark extracts of 'trial' specimens in species complex 2 (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with vanillin reagent, and (d) under UV 366 nm following development. As = *Acacia sieberiana*, Ax = *Acacia xanthophloea*, Aa = *Albizia adianthifolia*, Cs = *Croton sylvaticus*

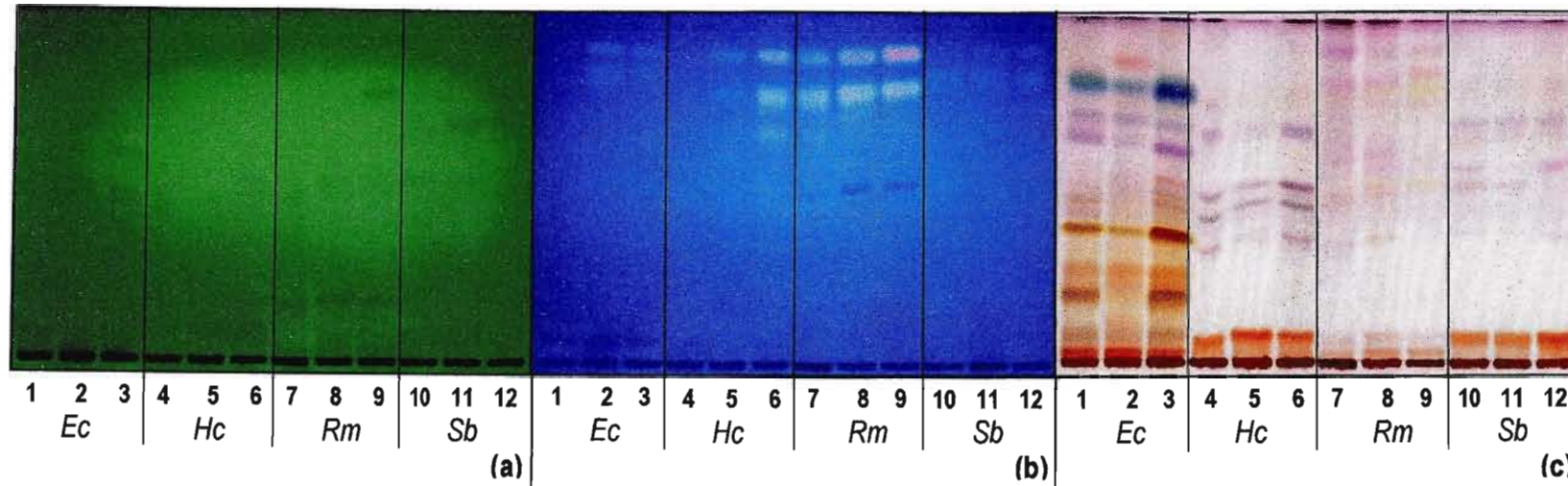


Figure 6.5 Chromatograms from TLC of ethanol bark extracts of three specimens per species in complex 1 (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with anisaldehyde reagent. *Ec* = *Ekebergia capensis*, *Hc* = *Harpephyllum caffrum*, *Rm* = *Rapanea melanophloeos*, *Sb* = *Schotia brachypetala*

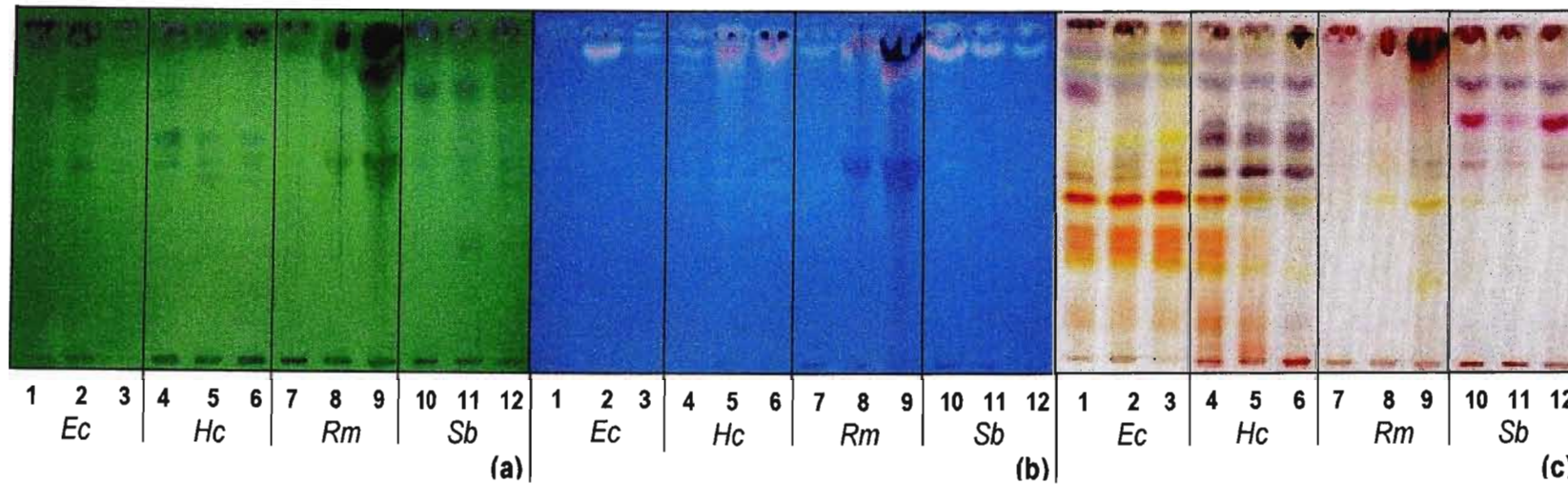


Figure 6.6 Chromatograms from TLC of hexane bark extracts of three specimens per species in complex 1 (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with anisaldehyde reagent. *Ec* = *Ekebergia capensis*, *Hc* = *Harpephyllum caffrum*, *Rm* = *Rapanea melanophloeos*, *Sb* = *Schotia brachypetala*

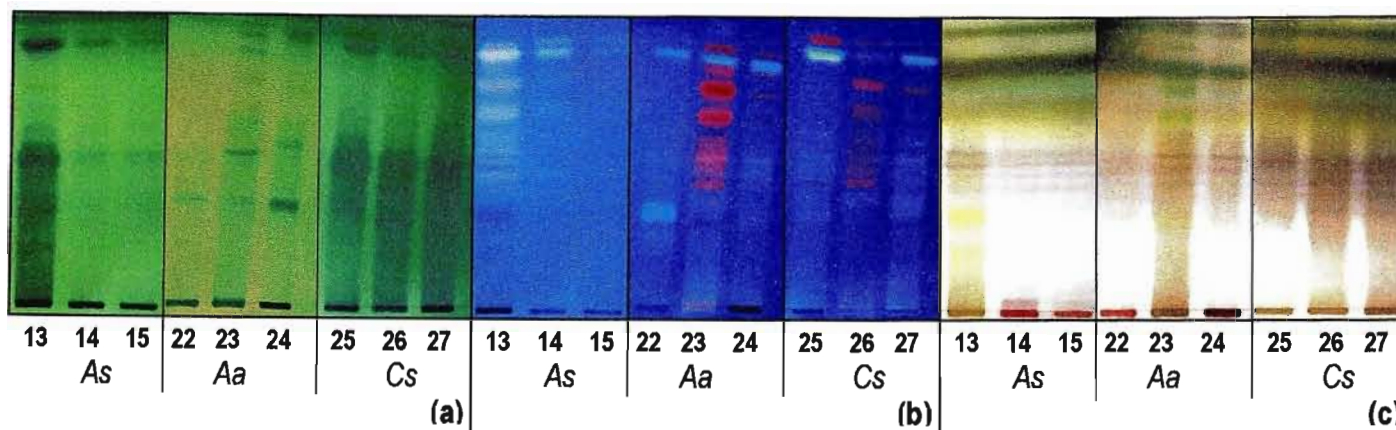


Figure 6.7 Chromatograms from TLC of ethanol bark extracts of three specimens per species in complex 2 (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with vanillin reagent. *As* = *Acacia sieberiana*, *Aa* = *Albizia adianthifolia*, *Cs* = *Croton sylvaticus*

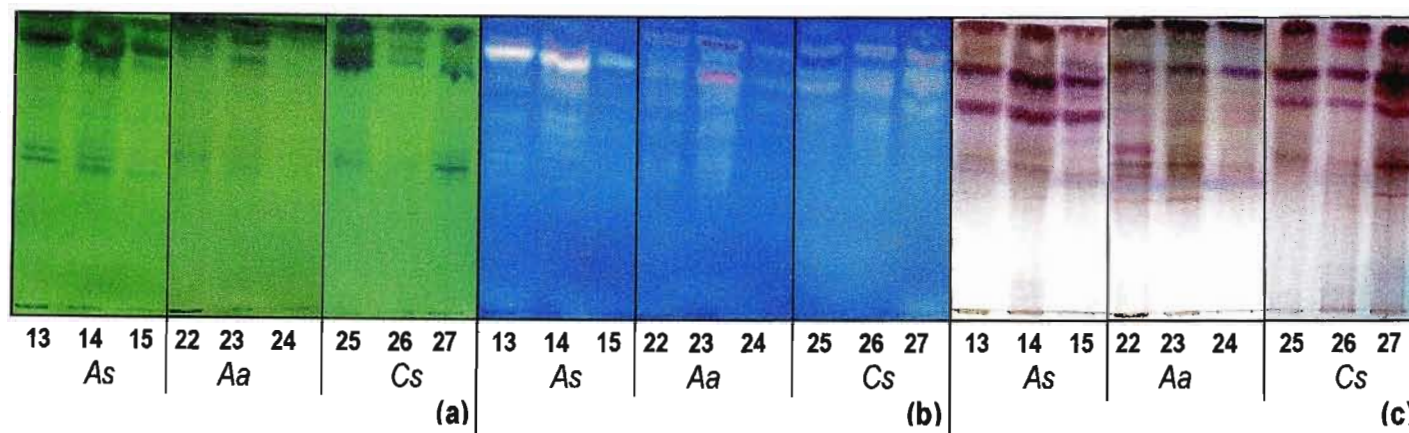


Figure 6.8 Chromatograms from TLC of hexane bark extracts of three specimens per species in complex 2 (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with vanillin reagent. *As* = *Acacia sieberiana*, *Aa* = *Albizia adianthifolia*, *Cs* = *Croton sylvaticus*

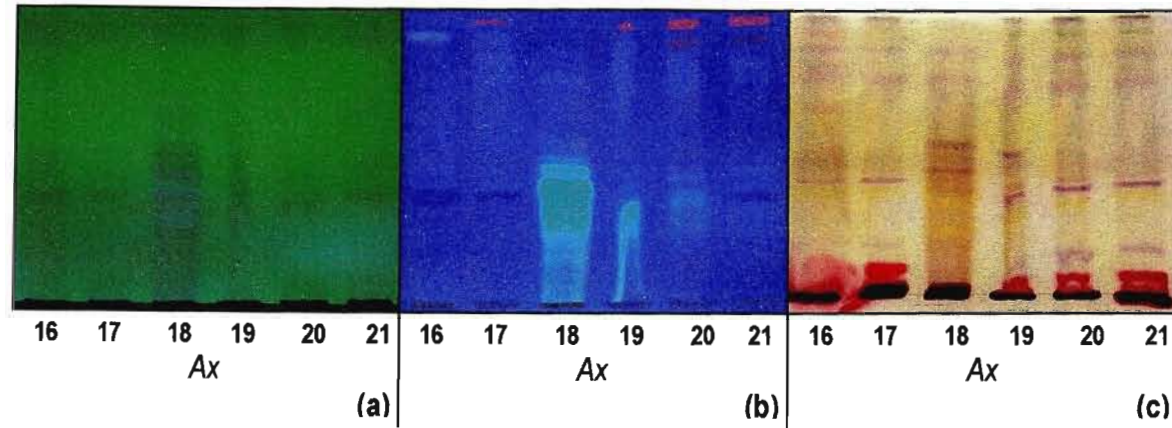


Figure 6.9 Chromatograms from TLC of ethanol bark extracts of six *Acacia xanthophloea* (Ax) specimens per species in complex 2 (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with vanillin reagent

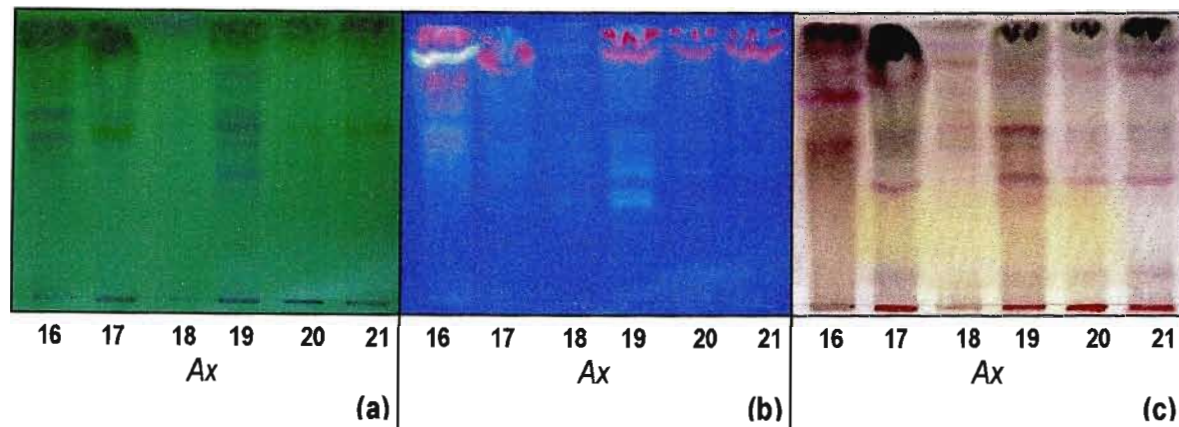


Figure 6.10 Chromatograms from TLC of hexane bark extracts of six *Acacia xanthophloea* (Ax) specimens per species in complex 2 (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with vanillin reagent

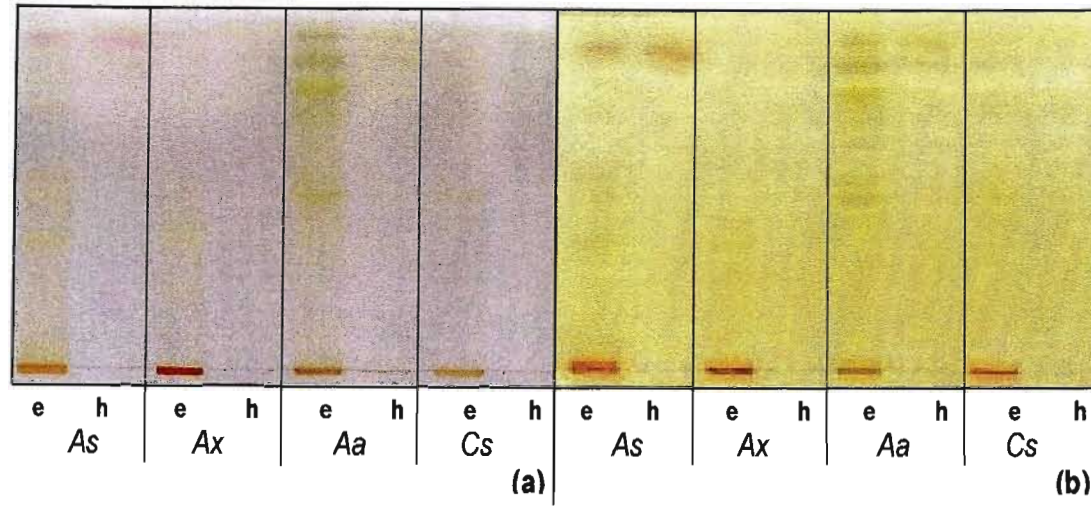


Figure 6.11 Chromatograms from TLC of ethanol (e) and hexane (h) bark extracts of 'trial' specimens in species complex 2 (a) prior to and (b) after development with Dragendorff reagent. As= *Acacia sieberiana*, Ax = *Acacia xanthophloea*, Aa = *Albizia adianthifolia*, Cs = *Croton sylvaticus*

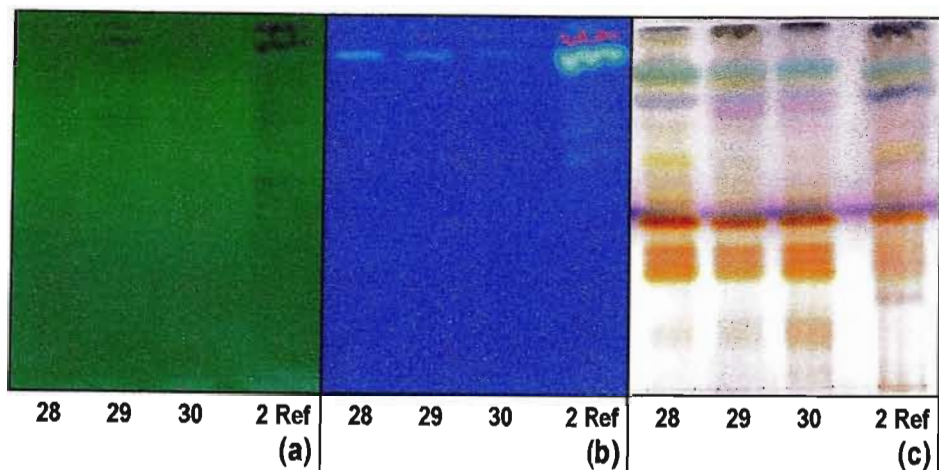


Figure 6.12 Chromatograms from TLC of medicinal bark products suspected to be *Ekebergia capensis* compared to a validated reference (Ref) (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with anisaldehyde reagent

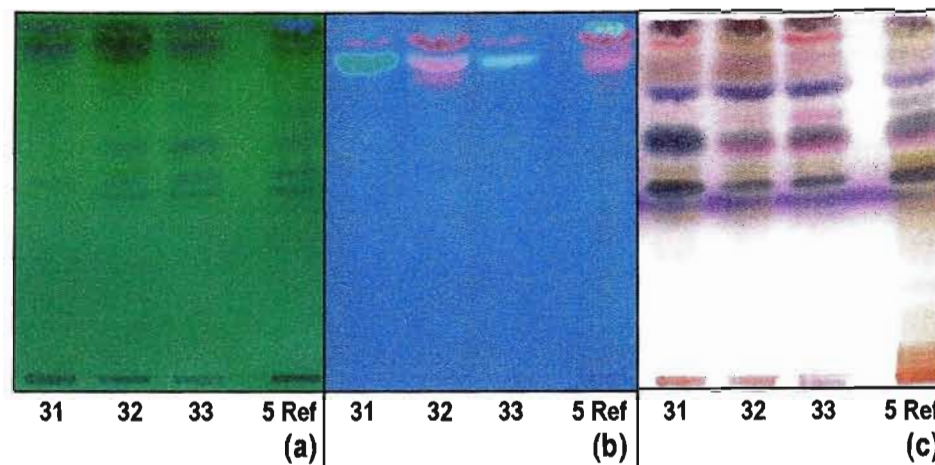


Figure 6.13 Chromatograms from TLC of medicinal bark products suspected to be *Harpephyllum caffrum* compared to a validated reference (Ref) (a) under UV 354 nm and (b) UV 366 nm prior to (c) development with anisaldehyde reagent

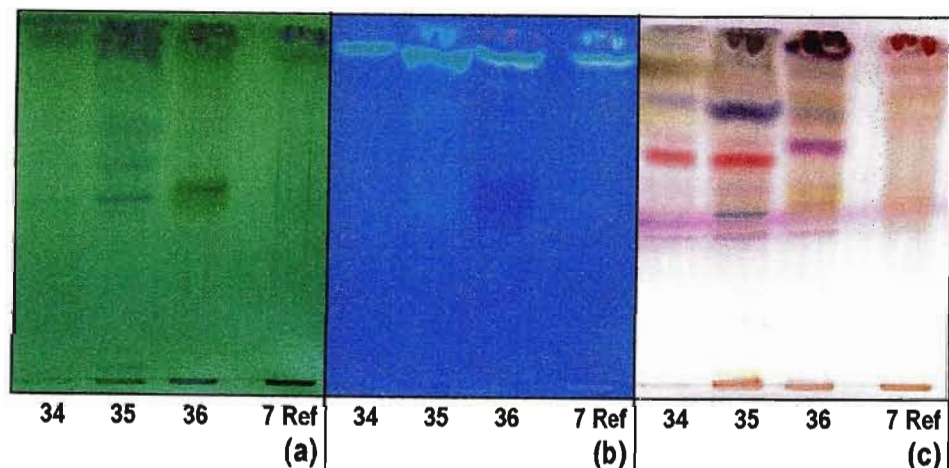


Figure 6.14 Chromatograms from TLC of medicinal bark products suspected to be *Rapanea melanophloeos* compared to a validated reference (Ref) (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with anisaldehyde reagent

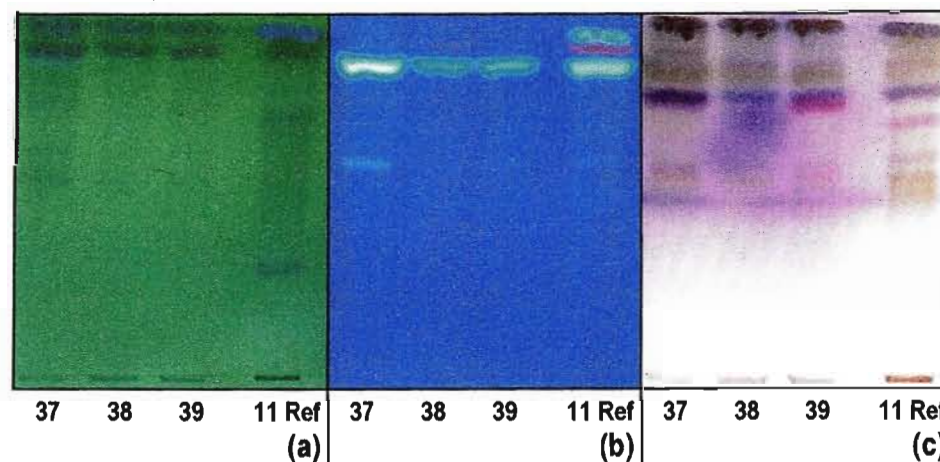


Figure 6.15 Chromatograms from TLC of medicinal bark products suspected to be *Schotia brachypetala* compared to a validated reference (Ref) (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with anisaldehyde reagent

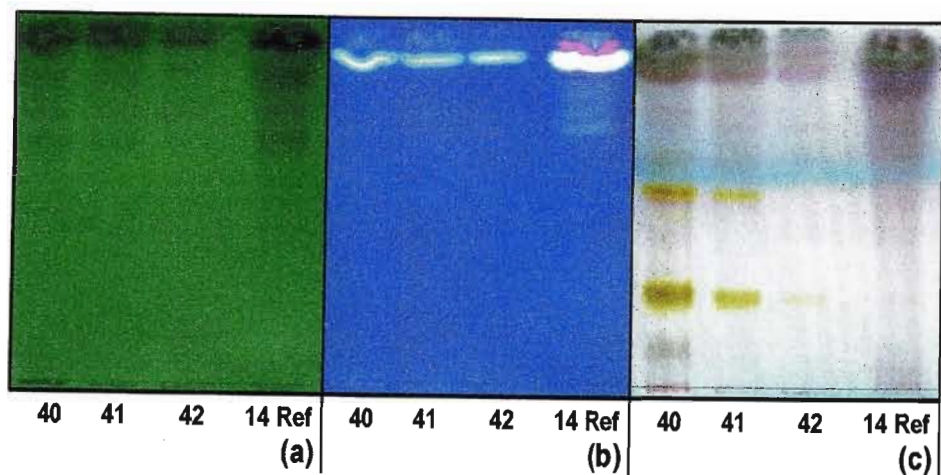


Figure 6.16 Chromatograms from TLC of medicinal bark products suspected to be *Acacia sieberiana* compared to a validated reference (Ref) (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with vanillin reagent

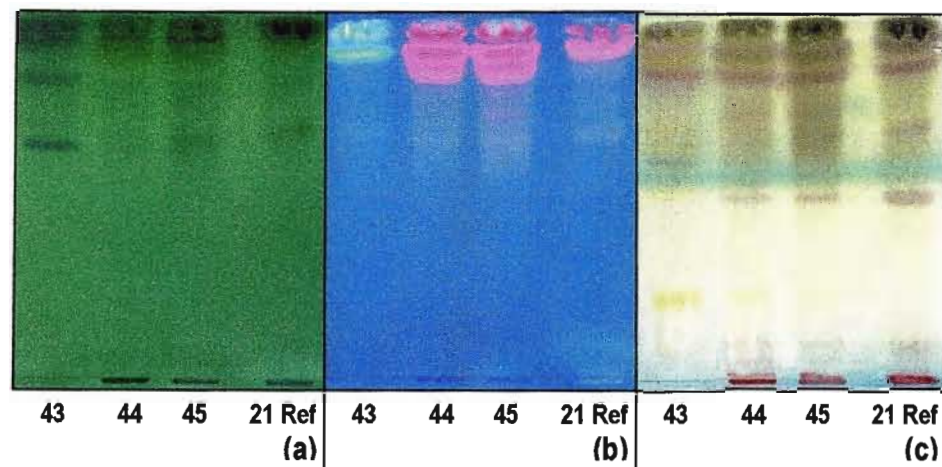


Figure 6.17 Chromatograms from TLC of medicinal bark products suspected to be *Acacia xanthophloea* compared to a validated reference (Ref) (a) under UV 354 nm and (b) UV 366 nm prior to (c) development with vanillin reagent

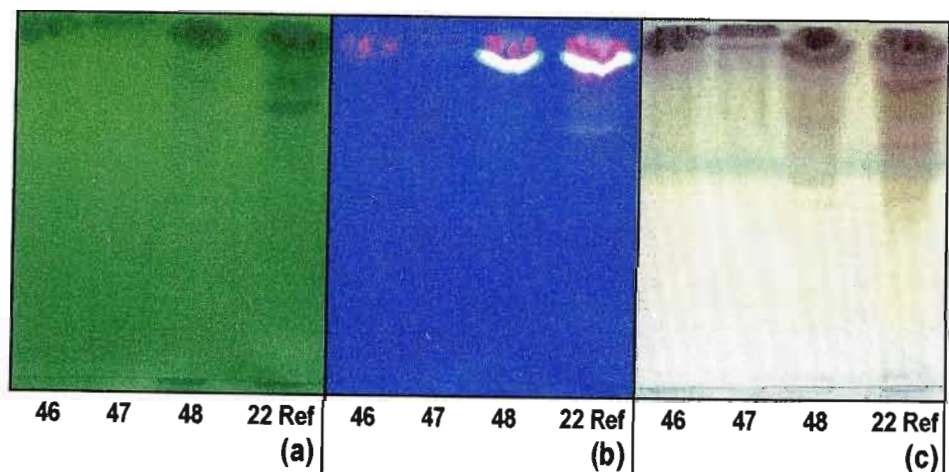


Figure 6.18 Chromatograms from TLC of medicinal bark products suspected to be *Albizia adianthifolia* compared to a validated reference (Ref) (a) under UV 254 nm and (b) UV 366 nm prior to (c) development with vanillin reagent

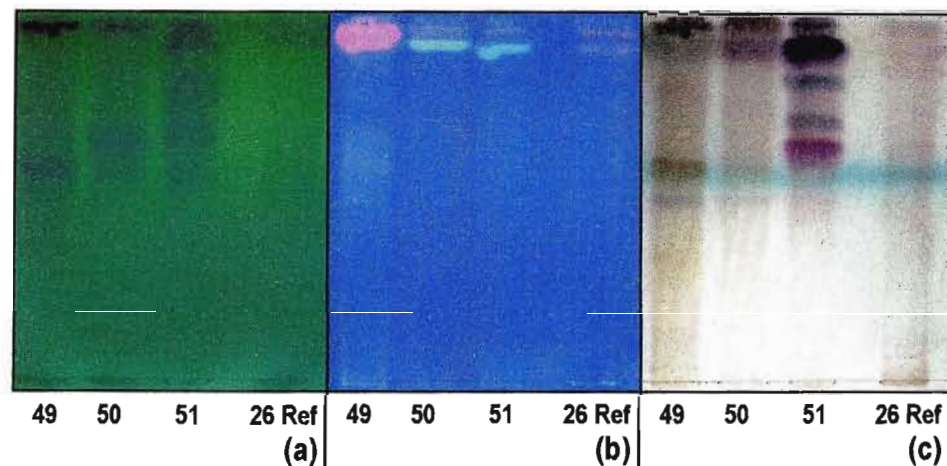


Figure 6.19 Chromatograms from TLC of medicinal bark products suspected to be *Croton sylvaticus* compared to a validated reference (Ref) (a) under UV 354 nm and (b) UV 366 nm prior to (c) development with vanillin reagent

Conclusions and foreseeable developments

Conclusions drawn from this research

Traditional medicine plays a critical role in meeting the healthcare needs of the majority of South Africans. Due to historical limitations in the organisation and administration of the traditional healthcare sector in this country, but under increasing demands for healthcare delivery, it evolved to the largely unregulated industry observed today. In the absence of regular and current data, the extent to which traditional healthcare is practiced and consulted, and economic turnover generated thereby, are difficult to quantify. The traditional pharmacopoeia, although inadequately documented, is clearly dominated by herbal medicines. Commercial trade in medicinal plants was stimulated during the twentieth century to meet the demands of the growing traditional healthcare sector, especially in urban areas, and these trends are expected to continue.

Although trees constitute a small fraction of the medicinal plants in South Africa, bark products from them are a dominant source of traditional medicines. Their medicinal efficacy has been demonstrated by pharmacological investigations of numerous species. Besides medicinal products, trees are valued for many other resources, including timber and Non-Timber Forest Products (NTFPs). Ironically, the delivery of healthcare, and employment generated by the traditional healthcare sector, threaten the resources on which they depend. The supply of plant medicines is sourced almost exclusively from indigenous vegetation and has been rendered non-sustainable at the current rate of exploitation in South Africa. In particular, plant species used for their bark are highly threatened by destructive harvesting methods, and because they occur in vegetation sensitive to degradation.

Medicinal bark products used in South Africa are harvested primarily from the Forest, Savanna, Grassland and Thicket biomes. Harvesting pressure exerted on indigenous vegetation in KwaZulu-Natal is intensive because the province represents the epicentre of the trade in traditional medicines. The Forest biome in KwaZulu-Natal is under greatest threat of degradation as it occupies only 0.1 % of the province, following significant losses as a result of early exploitation for timber and forest clearance for land use. Although non-sustainable usage is not a problem inherent to traditional healthcare, commercial bark harvesting today impacts not only upon resource availability, but also indirectly on the quality of traditional

bark medicines. Sustainable management practices adopted by modern conservation have yet to be fully implemented.

✘ Until sustainable usage systems are in place, medicinal plant cultivation, plant part substitution, and salvaging bark from indigenous timber operations, represent useful alternatives. In real terms, however, the volume of bark potentially obtainable from such ventures would not meet the demands of the traditional healthcare sector. The effects of inadequate supplies on the integrity of traditional bark medicines are likely to persist. ✘

Since medicinal bark products are easily misidentified or adulterated, and misadministration likely in the absence of regulated trade and practice of traditional healthcare, there is a need for reliable methods to authenticate bark medicines. Bark anatomy and morphology, and the identification of dried medicinal bark products, are problematic due to variable and frequently ephemeral characters. Phytochemical fingerprints of some bark species may be useful in their authentication, especially when coupled with anatomical and morphological characterisation.

The ethnobotanical literature neglects to reflect the importance of bark in South African traditional healthcare. The usefulness of the literature is limited by poor documentation of vernacular nomenclature, conservation and trade data, and management potential of species used for their bark. Traditional usage has been extensively documented but frequently without reference to user groups, and therefore limits the application of such data in answering questions of people-plant interactions. Unravelling the interaction between traditional healthcare and the South African flora may secure the future of both.

Progress in the foreseeable future

Regular data are required to monitor the role of traditional healthcare in South Africa, recognise the economy stimulated thereby, and the impacts of the medicinal plant trade on indigenous flora. The collection of such data, detailing user populations and trade in traditional medicines, could be incorporated in routine investigations undertaken by government or academic institutions and Non-Governmental Organisations (NGOs). Accurate data reflecting the demand for traditional plant medicines would greatly assist in the implementation of management practices to sustain renewable resources.

Additionally, there is a need for knowledge of bark harvesting responses at the specific level that will allow sustainable utilisation levels to be determined. Investigations of the effects of bark removal on some South African medicinal plant species are already underway. In addition to harvesting data, specialist

publications are required to document conservation and trade data that further indicate demands, and therefore threats, on indigenous flora. The increasing numbers of plant surveys undertaken in South Africa suggest that such data will become more readily available in the future. Without recognition of particular threats affecting medicinal species used for their bark, and impacts of bark harvesting at the individual level, it is unlikely that management practices will be successful in securing sustainability. Cultivation and other alternatives to the use of existing indigenous flora are likely to be most effective in securing the supply of medicinal bark products to the traditional healthcare sector.

Since the trade in traditional medicines is a lucrative one, control and standardisation of medicinal products are expected to be problematic. The prevailing situation of unregulated practice and trade needs to be addressed to protect users of traditional healthcare, but in turn requires progress to be made regarding legislature and administrative bodies governing the traditional healthcare sector. Although the process has commenced, it is likely to be a lengthy one. In the meantime, however, it is important that methods for the identification and authentication of medicinal bark products be determined and implemented where possible, to facilitate the transition to standardised traditional medicines in the future.


The literature potentially plays a substantial role in identifying problems and solutions that affect the sustainable use of the South African medicinal flora. Whilst the documentation and quantification of ethnobotanical data is innately difficult, much information does not require quantification, but specificity, to be useful. Rather than broad ethnobotanical surveys typical of many existing accounts, there is a need for depth and accuracy in the ethnobotanical literature to make it poignant to the conservation and sustainable use of economically important plant species. In particular, the role of bark needs to be addressed, since species used for their bark are among the most threatened medicinal taxa. These problems may have resolution in the increasing momentum of South African ethnobotanical research.

Closer inspections are required of the people-plant dynamics of South African traditional healthcare and the medicinal flora on which it is based. The multitude of factors that influence the interaction of healthcare and medicinal plants indicate the complexity of the task at hand. With multi-faceted and, importantly, co-ordinated and focussed research, the future of South African traditional healthcare and our indigenous flora may be secured.

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