

Minireview

A review of ethnobotanical research in southern Africa

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The diversity of plant species in southern Africa is matched by an equally rich cultural diversity, but traditional uses of plants have not yet been systematically recorded. Available information is fragmentary and widely dispersed in many different journals and books. A survey by Liengme (1983a) has shown several gaps in the scientific literature and some progress has been made towards a more complete record of indigenous plant use in the region. Information on some ethnic groups, such as the Khoi, Ndebele and Swazi, as well as the interaction between plants and people, folk taxonomies, plant-related mythology, ethnoveterinary medicine and pre-colonial plant use are some of the aspects that still remain poorly recorded. In contrast,

ethnopharmacology — particularly the testing of biological activity of crude extracts and isolated compounds — has received considerable attention in recent years. The aim of these studies is usually to validate traditional uses rather than to provide information for product development. A review of the literature on various categories of plant use, including recent publications and some hitherto unpublished research, is presented. Ethnobotany remains an underdeveloped discipline in southern Africa and there is an urgent need to systematically document indigenous knowledge on traditional plant use before it becomes irretrievably lost to future generations.

Introduction

Southern Africa is one of the global hotspots of biological and ethnic diversity. As such, the region provides exciting opportunities for scientific research that could be of major cultural and commercial significance. There is a growing international interest in ethnobotany, as is evidenced by the upsurge in cultural tourism (ethnotourism) that nowadays complements the already well-established ecotourism industry. At least 20 universities in the United States of America offer undergraduate and graduate courses in ethnobotany. Numerous scientific and semipopular books on the subject have appeared in recent years, including textbooks on approaches and methods (Martin 1995, Balick and Cox 1996, Heinrich 2001), dictionaries of plant use (Neuwinger 2000), full colour books on regional and local cultures (De Smet 1999, Van Wyk and Gericke 2000) or on the traditional uses of particular plant taxa.

There is no doubt that genetic resources will play an important role in the economic development of Africa (Atterre *et al.* 1991, Ng *et al.* 1991). The conservation of medicinal plant resources, the loss of indigenous cultures and the development of sustainable primary health care products from plants have also been highlighted in the so-called Chiang Mai Declaration in 1988 (WHO, IUCN and WWF 1993). The ethics of commercialisation and the pro-

tection of indigenous knowledge have become hotly debated issues (McGirk 1998, Nash 2001, Plotkin 2001; for a balanced review of the situation in South Africa, see George and Van Staden 2000). The principles of equitable sharing of benefits and access to genetic resources were formalised in the Convention on Biological Diversity, which was formulated during the Earth Summit in Rio de Janeiro in 1992 and subsequently ratified by nearly 180 countries, including South Africa (Wolfson 2001). The political and ethical dimensions of ethnobotany are of great interest to many people. An excellent review of the subject, including the concept of biopiracy and the much-discussed controversy over basmati rice patents, has recently been published (Crucible II Group, 2000). In this publication, it is pointed out that the playing field is not even, and that First World countries have better access to communication and information (there are more telephones in Tokyo than in the whole of Africa, for example!). Nevertheless, it has also been argued that the real winners in the biopiracy war are neither local communities nor foreign investors, but unscrupulous lawyers and journalists who do not bother to investigate the true facts (Nash 2001). In southern Africa, the most profound plant products are multi-cultural and have been in the public domain for at least a century. There would be more losers than winners if

ethnobotanical research and product development were to be slowed down by negative sentiments.

As far as new product development is concerned, a new era has already dawned in southern Africa. Bioprospecting is more active than ever before, and a large number of research groups are involved in medicinal plant research. Some patents have received attention in the media, particularly those on an appetite suppressant from *Hoodia* (Van Heerden *et al.* 1998) and a hypnotic from *Sceletium* (Gericke and Van Wyk 1997). Other South African plants of commercial interest for which various patents have been filed include *Agathosma betulina*, *Aspalathus linearis*, *Brackenridgea zanguebarica*, *Combretum caffrum*, *Combretum kraussii*, *Harpagophytum procumbens*, *Hypoxis hemerocallidea* and *Prunus africana* (United States Patent and Trademark Office, <http://www.uspto.gov>). Combrestatin A-4, a compound originally extracted from South African *C. caffrum*, has the unique ability to selectively disrupt blood vessels in tumors (Pettit 1994) and has passed phase I clinical trials in the United Kingdom. The so-called 'African potato' or inkomfe (*H. hemerocallidea*) has become a household name (Drewes and Horn 1999), but extracts of the plant, including rooperol (Drewes *et al.* 1984), are no longer used for its patented (Drewes and Liebenberg 1983) application against cancer. Likewise, the phytosterols used in immune-boosting products are no longer obtained from *H. hemerocallidea* (Pegel 1973, 1997) but the corms of the plant are nevertheless processed on a small scale for various traditional tonics. The cancer bush (*Sutherlandia frutescens*), a selected chemotype which is used commercially as a new adaptogenic tonic, has received considerable media attention in recent months because of its possible role in improving the quality of life of AIDS victims (Bisseker 2001, Morris 2001). Considerable progress has been made in developing this plant as well as buchu (*Agathosma betulina* and *A. crenulata*) and devil's claw (*Harpagophytum procumbens*) into new medicinal crop plants. Impressive product development in the aloe industry (based on local *A. ferox*) has taken place in recent years.

Two areas of research are particularly active. The first is ethnopharmacological studies, including the testing of extracts and isolated compounds. A large number of papers have been published on aspects of ethnopharmacology since the paper of Fourie *et al.* (1992) in which the important role of ethnobotany ('folk medicine') in pharmaceutical research was pointed out. An informative review that includes lists of important plant species and the most active research groups in South Africa is given by George and Van Staden (2000). There has been considerable progress in providing a scientific rationale for the use of numerous traditional remedies (for more details see below). The second active field of research is that of phytochemistry. A detailed review by George *et al.* (2001) summarises the main achievements and future prospects. The potential commercial value of research in these subdisciplines undoubtedly contributes to their popularity, and increases the opportunities for generating research funding. The documentation of ancient knowledge about plants and their uses, however, is less popular but seems much more urgent in view of the rapid pace of urbanisation and acculturation.

In this short overview of ethnobotanical research in southern Africa, the emphasis is therefore on the progress that has been made in exploring, documenting and systematically recording the informal, oral-traditional systems of plant use as they exist in the various cultural groups in South Africa. An attempt will be made to update the last review of this complex and multi-faceted subject by Liengme (1983a). National efforts to stimulate ethnobotanical research are mentioned and the most recent advances in the field are highlighted.

Historical Overview

Since colonial times, botanists and explorers have started recording the local uses of plants. The colonial Floras are often regarded as 'Plant Use Catalogues', and even systematic botany has its roots firmly in the practical aspects of botany, i.e. the value of plants to man. Unfortunately, traditional plant use in pre-colonial times is poorly documented and has to be extrapolated from recent records and current practices (see Cunningham 1988a for a rare attempt at doing so explicitly). Archaeological records could give some insight, such as rock paintings and engravings depicting *Harpagophytum procumbens*, *Stapelia flavirostris*, *Acacia tortilis*, *Rhus lancea*, *Massonia bowkeri* and *Boophane disticha* (Wilman, 1968) and *Aloe ferox* and *A. broomii* (Reynolds 1950). Plant remains comparable to herbarium specimens are rare, but have been analysed for Scott's Cave (Wells 1965), De Hangen (Parkington and Poggenpoel 1971), Melkhoutboom Cave (Deacon 1976) and remains of mongongo nuts (*Schinziophyton*) in the western Kalahari (Robbins and Campbell 1990). In the cave deposits, geophytes were particularly prominent, including *Watsonia* and *Hypoxis* species. Of special interest is a recent discovery in the Kouga/Baviaanskloof area of the mummified remains of a Khoi-San man buried nearly 2000 (1930 ± 20) years ago (Binneman 1999). Mummification was achieved by using *Boophane disticha* bulb scales and the body was covered with layers of branches of *Myrica serrata* and what appears to be *Liparia genistoides*.

Historically, ethnobotany has been studied by region, culture or language group. Publications covering large parts of southern Africa include the early traveller's accounts of Van der Stel (Human and Rousseau Publishers 1979), Thunberg (Forbes 1986) and Burchell (1822–1824), as well as colonial Floras (Harvey and Sonder 1862 and subsequent volumes) and later Floras (Marloth 1913–1932). These sources contain numerous references to the indigenous *materia medica* of South or southern Africa, but early books dedicated entirely to this subject are those of Pappe (1847, 1850, 1857) and Smith (1895), leading eventually to the great classic by Watt and Breyer-Brandwijk (1962).

Ethnobotany has also been studied by region, such as the excellent account of Kaokoland by Malan and Owen-Smith (1974). Most studies have concentrated on a single cultural group — examples are the classical works on the ethnobotany of the Zulu (Bryant 1966) and the San (Story 1959). Several more recent studies are listed below. Name lists and dictionaries (Van Warmelo 1937, Smith 1966) contain significant numbers of ethnobotanical anecdotes but these were

often overlooked, underestimated or misinterpreted. Smith (1966), for example, is notable by its absence from the excellent review on ethnobotany by Liengme (1983a).

Recent changes in the socio-political landscape of southern Africa have resulted in an increased interest in ethnobotany. The role that indigenous knowledge and ethnobotany can play in an African renaissance should be obvious to everyone — a rediscovery or revival is hardly possible when all or most of the ancient knowledge has disappeared forever. The obvious need to stimulate ethnobotanical research resulted in a special programme, known as the Indigenous Plant Use Forum (IPUF), coordinated by the National Research Foundation (NRF), previously known as the Foundation for Research Development (FRD). As a separate initiative, a multi-disciplinary meeting ('indaba') on Indigenous Knowledge was held at the South African Museum in Cape Town in November 1994 (Normann *et al.* 1996).

The Indigenous Plant Use Forum (IPUF) resulted from a workshop held in the Magaliesberg Conference Centre in August 1992. The workshop was sponsored by the FRD (currently known as the NRF), the National Botanical Institute, The Institute of Natural Resources, the Southern Foundation and Gencor. A programme description was written by AB Cunningham, PJ de Jager and LCB Hansen, in which the envisaged aims and objectives of a national programme in ethnobotany, as proposed by the 40 persons attending the workshop, were published (Cunningham *et al.* 1992). IPUF was launched in January 1993, with Dr Carl Albrecht (University of Stellenbosch) as first chairperson. The aim was to coordinate a national effort to 'promote the cultural, socio-economic and scientific benefits to be derived by people from the sustainable use of the southern African flora'. During the period 1993 to 1995, communication between ethnobotanists in southern Africa was much improved by a newsletter, *The Indigenous Plant Use Newsletter*, with Jenny Mander as editor. Funding to stimulate research activity in ethnobotany and indigenous plant use was provided by the FRD (now the NRF), particularly to a five-year programme at the Centre for Indigenous Plant Use (CIPUR), under the leadership of Prof. Pat Berjak, based at the University of Natal in Durban. Staff members of the FRD (now the NRF), particularly Jenny Hale, Mandy Bunker and Bettie de Beer, have played an important role in administering and supporting the programme. Useful directories of all people involved in Indigenous Plant Use research were published (Anati *et al.* 1994, Hale *et al.* 1995). Several regional and annual meetings were held, and a symposium was organised in Stellenbosch in January 1996, immediately after the annual conference of the South African Association of Botanists.

Annual symposia of IPUF have been organised in recent years by Bettie de Beer from the NRF and myself (as chairperson of IPUF since 1995): Louis Trichardt, 1998 (Theme: Ethnobotanical surveys in South Africa); Richards Bay, 1999 (Theme: Indigenous knowledge in transition — ethics and marketing issues); Nelspruit, 2000 (Themes: Role of Horticulture in Product Development, Transfer of Indigenous Knowledge and Patenting and Breeders' Rights) and Kimberley, 2001 (Themes: Community Benefits: 'Plant

Power to the People' and Biological Activity: 'Green Weaponry against Disease'). The purpose of these annual meetings is to provide an opportunity for traditional healers, community workers, conservationists, scientists, researchers, business people, policy makers and everyone else interested in the sustainable use of the wonderfully rich Flora of South Africa to meet in an informal atmosphere. The IPUF meetings are remarkable in that they are truly multi-disciplinary, with people from a wide variety of backgrounds and disciplines sharing ideas, research results and general information on indigenous plants and their uses. Growing interest in the IPUF meetings is evident in the number of persons attending — 65 in 1998 to 134 in 2001. A new newsletter, *Southern African Ethnobotany*, was started in September 1999 with Lynn Katsoulis and Robyn van Zyl (both from the University of Witwatersrand Medical School) as editors. All of these initiatives have undoubtedly played a role in stimulating ethnobotanical research, and there are now active research groups at practically all centres of tertiary education in southern Africa. A further stimulus was the establishment of Indigenous Knowledge Systems as a dedicated focus area at the National Research Foundation in 1999.

General Ethnobotany

Surprisingly few publications are available that deal with southern African ethnobotany in general. Most of the available literature focuses on a single region, culture or category of plant use. Broad overviews of ethnobotany in southern Africa are those of Liengme (1983a), Cunningham (1989), Cunningham *et al.* (1992) and Van Wyk and Gericke (2000). In a regional context, there have been several important contributions to enrich the now classical earlier contributions mentioned in Liengme (1983a). These include the books by Rodin (1985) on Kwanyama Ovambos and Van den Eynden *et al.* (1992) on the Topnaar Khoi. The previously overlooked paper by Jacot-Guillarmod (1966) covers useful plants of Lesotho, while Ellert (1984) has filled an important gap for Zimbabwe. Von Koenen (1996, 2001) provides a valuable account of traditional plant use in Namibia. Several classical contributions are worth mentioning here — on the San by Story (1959), Heinz and Maguire (1974) and Steyn (1981), the Tsonga by Liengme (1981), the Herero by Malan and Owen-Smith (1974) and the Lobedu by Davidson (1984). Dold and Cocks (2000) studied plant use by the amaXhosa people, Larson (1975, 1981, 1986) described the ethnobotany of the Hambukushu in Botswana, while Bandeira (1994) reported aspects of plant use in Mozambique. The paucity of information on Khoi has been supplemented by Archer's (1982, 1990, 1994) work on plant uses in Namaqualand. A number of important contributions in the form of unpublished theses have also been made. Examples include Mabogo (1990) on Venda ethnobotany, Van der Merwe (2000) on Tswana ethnoveterinary medicinal plants, Eckert (2000) on Northern Ndebele resource management and Rankoana (2000) on the ethnobotany of the Dikgale community (North Sotho). Resource ecology, the conservation of resources, the value of indigenous plants to local communities and quantitative methods in ethnobotanical

survey work have become popular and important research fields in recent years. Examples of publications are Campbell 1976, Cunningham (1985, 1987, 1989, 1992), Muir (1991), Dzerefos *et al.* (1995) and Shackleton (1990, 1996, 2000).

The value of name lists, dictionaries and encyclopedias is often overlooked. An example is the appendix of plant names to the Tshivenda-English dictionary of Van Warmelo (1937). The list of linguistically accurate Setswana plant names (Cole 1995) sets an example for the way in which linguists can contribute to ethnobotany. There is a need for more publications on vernacular names, such as the ones by Johnson (1990) and Dold and Cocks (1999a) on Xhosa plant names, the list of Eiseb *et al.* (1991) on Nama/Damara names and the recently compiled comprehensive list of tree names in 21 southern African languages by Von Breytenbach *et al.* (2002, in press).

Food and Beverages

An overview of the literature is presented by Van Wyk and Gericke (2000). The major contribution of Fox and Norwood Young (1982) has been supplemented by several important publications, including a list of all edible plants of sub-Saharan Africa (Peters *et al.* 1992) and the book by Rood (1994a). Notable contributions are those of Quin (1959) on Pedi food plants and Archer (1982, 1990, 1994) and Arnold *et al.* (1985) on Khoi-San food plants. Interesting work on primitive crop plants in the Northern Province (Arnold and Musil 1983) have been followed up by the Agricultural Research Council at Roodeplaat. Research is being undertaken on indigenous food crops such as *Plectranthus esculentus* (Allemann and Coertze 1996), *Vigna subterranean* (Venter and Coertze 1996), *Cajanus cajan* (Venter and Coertze 1997), *Amaranthus hybridus* (Van den Heever and Coertze 1996) and *Cleome gynandra* (Van den Heever and Coertze 1997). The work of Wehmeyer (1986) on the nutritional value of indigenous foods (see also the tables in Fox and Norwood Young (1982)) has been taken further by Singo (1996), Nesamvuni (2000), Nesamvuni *et al.* (2001) and Steyn *et al.* in press, who studied the nutritional value of indigenous green vegetables in the Northern Province. Similar studies are those of Meyer (1999) for KwaZulu-Natal, Ogle and Gravetti (1985) for Swaziland and Santos Oliveira and Fidalgo de Carvalho (1975) for Mozambique.

The value of indigenous fruits has received special attention from Campbell (1987), Swart (1988–1991), Ackhurst (1996), and Maghembe (1994). The domestication of marula (*Sclerocarya birrea*) is an ongoing process (Von Teichmann 1983, Goosen 1985, Burger *et al.* 1987, Holzhausen 1993). Brutsch and Zimmerman (1993) reviewed the uses of prickly pear in southern Africa. The possible commercialisation of marama bean, *Tylosema esculentum* (Keegan and Van Staden 1981, Powell 1987) and its nutritional value (Bower *et al.* 1988) is also of considerable interest. African horned cucumber (*Cucumis metuliferus*) has been developed as a new commercial fruit with the brand name 'Kiwano' (Morton 1987). In a cultural context, manketti or mongongo (*Schinziophyton rautanenii*) has been the subject of several interesting studies (Lee

1973, Peters 1987, Robbins and Campbell 1990), while an elegant account of the role of the nara fruit (*Acanthosicyos horridus*) is given by Dentlinger (1977) and Van den Eynden *et al.* (1992).

Rooibos tea (*Aspalathus linearis*) has become an important industry (Dahlgren 1968, Morton 1982, Van der Walt and Machado 1992). The increasing international popularity of this health beverage is reflected in a 40% increase in exports in 2001. The effect of processing and the antimutagenic and antioxidant potentials of 'fermented' and 'green' rooibos tea are currently receiving attention (Joubert 1996, 1998, Marnewick *et al.* 2000, Standley *et al.* 2001). Although still modest in size, the honeybush tea industry (Van Tonder 1981, Smit 1982, De Lange 1997) is expanding and there have been important improvements in processing (Lance Graven pers. comm., Du Toit and Joubert 1999). Various aspects of palm wine production, including conservation, yields and marketing were investigated in detail by Cunningham (1990a, 1990b) and the nutritional value by Cunningham and Wehmeyer (1988). Mead or honey beer ('karrie') needs further study, as does the scientific rationale behind the numerous traditional yeast plants of southern Africa (Van Wyk and Gericke 2000).

Health and Beauty

The most comprehensive treatment of traditional medicine in South Africa remains the encyclopaedic work of Watt and Breyer-Brandwijk (1962) but some recently published books have helped to conceptualise traditional medicine and to add new information. These include Jansen and Mendes (1983, 1984, 1991), Palmer (1985), Gumede (1990), Pujol (1990), Roberts (1990), Rood (1994b), Hutchings *et al.* (1996), Van Wyk *et al.* (1997), Felhaber (1997) and Van Wyk and Gericke (2000). Traditional medicine is surprisingly dynamic and adaptive, as shown by interesting studies of De Wet (1998) and Dold and Cocks (1999b). The important medicinal plant market survey of Cunningham (1988b), has been supplemented by Williams (1996, 1997) and Mander (1998). Several data bases have been developed (or are currently under development), such as the Noristan data base (currently administered by the University of Cape Town) and Medbase, a data base developed jointly by the National Botanical Institute and the Department of Environmental Affairs and Tourism (Crouch and Arnold 1997). The popularity of medicinal plants is also reflected in the issuing of a set of 10 postage stamps by the South African Post Office on 1 August 2000 (Anon 2000).

Perhaps the most lasting contributions to medical ethnobotany come from complete surveys of individual cultures or communities, where the full diversity of medicinal plant use is documented for posterity. A complete and systematic documentation allows us to understand the relative importance of particular species for specific indications. There have been a few important contributions using this approach, such as the books by Rodin (1985) and Van den Eynden *et al.* (1992). A milestone was the publication of the comprehensive overview of Zulu medicinal plants by Hutchings *et al.* (1996), thereby updating the classical work of Bryant (1966). Valuable lists of medicinal plants are those

of Hutchings (1989a, 1989b), and Hutchings and Van Staden (1994). A Venda pharmacopoeia was compiled by Arnold and Gulumian (1984) and a list of Northern Sotho medicinal plants by Venter (1997). The medicinal practices of the Hambukushu in Botswana were described by Larson (1986) and those of the Tsonga by Liengme (1981). Also notable are studies on medicinal plants of the Transkei and Eastern Cape Province (Youthed 1992, Bhat and Jacobs 1995, Grierson and Afolayan 1999a, 1999b, Matsiliza and Barker 2001), Botswana (Hedberg and Staugård 1989, Anderson and Staugård 1986), Zimbabwe (Gelfand *et al.* 1985). Two recent studies are those of Eckert (2000) on the Laka community of Mapele and Rankoana (2000) on the Dikgale community in the Northern Province. An interesting insight into Khoi medicinal practices is given by the often overlooked Laidler (1928), while aspects of Khoi, Cape Dutch and Afrikaner traditional medicine are found in Pappe (1847, 1850, 1857); Smith 1895, Dykman 1891, Kling 1923, Anon 1962, Palmer 1985, Ferreira 1987, Roberts 1990, Archer 1990, 1994, Cillié 1992, Anon 1993, Rood 1994b, Shearing 1994, Van Wyk *et al.* 1997, Van Wyk and Gericke 2000, Vergoes Houwens no date, Wileman no date).

Neglected study fields that require more attention are traditional dental care (Li *et al.* 1998, Kassu *et al.* 1999, Van Wyk and Gericke 2000), traditional cosmetics (De Lange 1963, Khan 1996, Van Wyk and Gericke 2000), indigenous perfumes (Endenburg 1972, Moran *et al.* 1975, Demarne and Van der Walt 1989, Graven *et al.* 1992, Weyerstahl *et al.* 1992, Gundidza and Zwaving 1993, Posthumus and Van Beek 1996, Van Wyk and Gericke 2000) and indigenous stimulants (Watt 1967, Dobkin de Rios 1986, Winkelman and Dobkin de Rios 1989, De Smet 1996, Smith *et al.* 1996, Van Wyk and Gericke 2000). The available information and literature in these fields were summarised by Van Wyk and Gericke (2000) but there is much scope for systematic investigations and for in-depth studies of particular plant taxa. Ethnoveterinary medicine is a poorly developed research field with much potential. Valuable contributions can be made by simply recording the traditional uses of plants to treat domestic animals, including cattle, sheep, goats, donkeys, ostriches, chickens, dogs, etc. Van der Merwe (2000) and Masika *et al.* (2000) are recent examples of valuable contributions in this field, and hopefully more such studies will follow in future. Toxic plants are of medical and forensic interest and are relatively well recorded. Neuwinger (1994, 1996) reviewed African plant poisons and added to the early literature (Walsh 1909, Phillips 1926, Steyn 1934, 1949, Watt and Breyer-Brandwijk 1962). Livestock poisoning is covered by Vahrmeijer (1981) and comprehensively so by Kellerman *et al.* (1988). A new photographic guide to the poisonous plants of South Africa is in press (Van Wyk *et al.* in press).

Botanists and organic chemists from several universities and institutions in southern Africa have been collaborating closely in recent years to explore the biological activity of traditional medicinal plants. A detailed review of the researchers involved and the main plants of interest are given by George and Van Staden (2000) and George *et al.* (2001). As a result of these activities, it may be argued that ethnopharmacology has become the most popular and pro-

ductive ethnobotanical research activity. The studies are aimed mainly at validating the traditional uses of plants although the commercial potential of particular plants and various aspects of commercialisation have also received some attention.

Numerous studies have focussed on antimicrobial activity (Dekker *et al.* 1983, Salie *et al.* 1996, Afolayan and Meyer 1997, Martini and Eloff 1998, Mashimbye *et al.* 1999, Mathekga *et al.* 2000, Kelmanson *et al.* 2000, Van der Watt and Pretorius 2001, Eloff 2001), as well as the techniques and social relevance of the work (Eloff 1998, 2000). Studies specifically directed at wound healing include Grierson and Afolayan (1999a, 1999b). Plant extracts have been tested for antineoplastic activity (Opoku *et al.* 2000), anti-inflammatory activity (Dekker *et al.* 1988, Fourie and Snyckers 1989, Jäger *et al.* 1996, Lin *et al.* 1999), antimalarial activity (Campbell *et al.* 1997, 1998), antidiarrhoeal activity (McGaw *et al.* 2000), angiotensin converting enzyme inhibitors (Duncan *et al.* 1999), prostaglandin-synthesis inhibitors (Lindsey *et al.* 1998), anticonvulsant activity (Amabeoku *et al.* 1998), antischistosomal activity (Sparg *et al.* 2000) and analgesic and antipyretic effects (Amabeoku *et al.* 2001). Pregnancy-related traditional herbal medicines were studied by Veale *et al.* 1992 and Varga and Veale (1997), the treatment of herpes by Meyer *et al.* (1996) and tuberculosis by Lall and Meyer (1999). Only some examples are given here — for a more comprehensive list of publications, recent volumes of the Journal of Ethnopharmacology and other journals should be consulted.

Basic research in the pharmacology, chemotaxonomy and biosystematics of medicinal plants is an important priority (Van Wyk 1996) because it provides a deeper understanding without which no innovation will be possible. However, to achieve success in the commercial world and to gain financial and material benefits for local people, the following actions are needed to ensure rapid progress:

1. More focus on commercialisation. In plant-based industries, science often plays a very small part in the early stages of new product development. Even in the herbal industry, science and research do not usually lead but rather follow the market. *Aloe vera* gel, for example, has become a major tonic even though the scientific basis for its immunostimulatory activity has only very recently become evident. The activity is now ascribed to aloeride, a new polysaccharide that comprises a mere 0.015% of the dry weight of aloe juice (Pugh *et al.* 2001). Another example is *Harpagophytum procumbens* (devil's claw), which is well established as a medicinal plant of international importance, as reflected in it being treated in one of the first ESCOP monographs of the new European pharmacopoeia. Until now the main focus has been on iridoids (mainly harpagoside), so that the discovery of alkaloids (Baghdikian 1999, Balasard 1999) is somewhat unexpected.
2. Clinical trials. Several indigenous herbs are now at a stage of development where proof of safety and efficacy is an important priority. The first clinical trial in South Africa on extracts of an indigenous plant, *Hypoxis hemerocallidea* (Albrecht *et al.* 1995a, 1995b, Smit *et al.* 1995), is of considerable historical interest despite the disappointing

final outcome. Carefully designed clinical trials on appropriate indications are a first step in developing local and international markets for indigenous plant products. *Harpagophytum procumbens*, for example, has become increasingly popular as a phytomedicine after scientific proof of efficacy against arthritis and low back pain (Lecomte and Costa 1992, Chrubasik *et al.* 1996) has resulted in its early inclusion in the new ESCOP monographs. For indigenous plants, the three formal phases of clinical trials (Phase I — is it safe? Phase II — what is the best dosage? Phase III — does it work better than existing treatments?) can perhaps be combined into one for a traditional medicine with a long history of safe use and with credible anecdotes on efficacy.

3. More focus on the top plants. The majority of indigenous plants with commercial potential are already widely known, precisely because they have proven to be valuable to many people over a long period. The virtues of *Aloe vera* (originally a North African plant) have been documented in the earliest literature, including the classical 'de Materia Medica' of Dioscorides (for a modern translation see Osbaldeston 2000). Do we really have to find 'new' plants for commercialisation when so many are already well documented and widely used? The challenge is to grow large industries around those species that have already shown their value and market acceptance. It may be the best strategy to spend 80% of the research and development effort on the top 20% of plants.
4. Less emphasis on political issues, such as intellectual property rights. Knowledge has no commercial value until it has been applied. In the modern world, through publications and the electronic media, knowledge and information have become freely available to all on an unprecedented scale. It is not knowledge itself, but the application of knowledge that creates wealth. Commercialisation is a complicated process that requires management skills, hard work and the willingness to take financial risks — hence the large rewards to daring individuals (or more often the heavy losses, if things go wrong). The success of the *Aloe vera* industry, currently estimated to have a retail value of 110 billion US dollars, is not based on some tribal secret but on the skill and hard work of two generations of bold entrepreneurs. The same can be said for the rooibos tea industry.
5. More focus on propagation and sustainable production. Wildharvesting and wildcrafting may be appropriate to develop an industry, or even to maintain a small industry — see Newton and Vaughan (1996) on the *Aloe ferox* industry in South Africa. However, it is clearly not sustainable in the long run if the venture is really successful, because there may be no guarantee of supply (massive scale-up may not be possible), and no consistency in quality (standardisation may be problematic or impossible) — see Van Wyk *et al.* (1994) on geographical variation in *Aloe ferox*. Species that are difficult to propagate are less likely candidates for commercial development, as are species where destructive harvesting is necessary (such as the use of bulbs and bark). There are serious concerns about the conservation status of *Prunus africana* in tropical Africa as a result of large-scale bark harvesting

(Cunningham *et al.* 1997). More emphasis is therefore needed on new crop development and research related to the propagation and cultivation of plants with commercial potential. Pioneers in propagation and new crop development are, amongst others, CL Leipoldt, P Nortier and J van Putten (*Aspalathus linearis*), EH Graven (*Agathosma betulina*, *Artemisia afra*, *Harpagophytum procumbens* and *Sceletium tortuosum*), U Feiter (*Pelargonium sidoides*), FK Peters (*Xysmalobium undulatum*), G Nichols, JN Eloff and A van Rooyen (*Siphonochilus aethiopicus*), LC Holzhausen (*Sclerocarya birrea*), H de Lange (*Cyclopia* species), J van Staden and co-workers (*in vitro* propagation of medicinal plants) and G Nichols and the Durban Municipality (early cultivation of medicinal plants at the Silver Glen Medicinal Plant Nursery).

Skills and Crafts

The revival of arts and crafts for commercial purposes in southern Africa will hopefully also stimulate systematic research into the uses of plant materials. An overview of various categories of indigenous skills and crafts is presented by Van Wyk and Gericke (2000) and some aspects will only be briefly summarised here. Skills and crafts have been recorded in most of the general ethnobotanical references listed above, to which can be added some studies on the crafts of the Hambukushu of Botswana (Larson 1975, 1981) and of the local people of Inhaca Island, Mozambique (Bandeira 1994). The uses of individual plant species have also received attention, such as *Sclerocarya birrea* (Von Teichmann 1983), *Adansonia digitata* (Wickens 1982) and *Colophospermum mopane* (Madzibane and Potgieter 1999). Basketry is perhaps the most lucrative of the local crafts (Lamprecht 1976, Levinsohn 1979, 1984, Sutton 1994, Terry 1987, 1994) and a large diversity of plant materials are used. Examples are the leaves of *Hyphaene petersiana* in Botswana, Namibia and Zimbabwe (Cunningham and Milton 1987), *H. coriacea* in Maputaland (Cunningham 1988c), various grasses and sedges (Cunningham and Gwala 1986, Heinsohn and Cunningham 1991, Moffett 1997) and the stems of creepers such as *Flagellaria guineensis* (Cawe and Ntloko 1997). Indigenous dye plants used for the patterns and colours of baskets have not yet been systematically studied but some are treated in recent literature (Marincowitz 1985, Cunningham 1987, Cunningham and Milton 1987, Gumede 1990, Van Wyk and Gericke 2000). The existence of a pre-colonial textile industry based on wild cotton, *Gossypium herbaceum* subsp. *africanum* is worth mentioning (Ellert 1984), as is the use of various bark fibres to produce gudza cloth and other textiles (Ellert 1984). The production of mats from various grasses, sedges or rushes is a particularly interesting aspect of indigenous plant use in southern Africa that has not been systematically studied (Van Wyk and Gericke 2000). Mats are used for house construction in the Nama culture (Haacke 1982, Archer 1989) and as sleeping mats and sitting mats (Van Wyk and Gericke 2000). Thatching materials also require further study to complement existing literature (Long 1978, Linder 1991, Heinsohn and Cunningham 1991). Research projects have recently been started on various traditional and non-tradi-

tional sources of plant fibre for possible commercial development.

The use of indigenous and exotic timbers is mentioned in various publications and much information undoubtedly remains to be recorded. Books on trees usually include anecdotes on various uses of the timber (Poynton 1975, Coates Palgrave 1977, Pooley 1993, Venter and Venter 1996, Van Wyk *et al.* 2000), sometimes adding new data but usually relying heavily on the wealth of information given by Palmer and Pitman (1972). The use of timber for traditional home construction (Knuffel 1973, Johnson 1982, Cunningham and Gwala 1986, Geldenhuys 1991), carving (Hooper 1981) and various other purposes such as musical instruments (see references listed in Liengme 1983a, MacGillivray 1999) have been recorded. Fuelwood requirements have been studied by Best (1979), Furness (1981a, 1981b), Le Roux (1981), Banks (1981), Liengme (1983b), Basson (1987) and Campbell and Du Toit (1988), while traditional methods of fire-making were described by Friede (1979). Hunting and fishing poisons are briefly mentioned in several publications and are reviewed by Neuwinger (1994, 1996). Von Koenen (1996, 2001) lists several records for Namibia. There is undoubtedly still a large body of unrecorded information on various aspects of traditional crafts and the plant materials that are used. The general review by Van Wyk and Gericke (2000) shows the obvious gaps that require further research and documentation.

Conclusions

Ethnobotany seems to have claimed its rightful place amongst the scientific disciplines receiving research funding, but much work remains to be done. There is still a wealth of unrecorded information, especially relating to the ethnobotany of the Khoi, Ndebele and Swazi, as well as the interaction between plants and people, folk taxonomies, plant-related mythology, ethnoveterinary medicine and pre-colonial plant use. To these may be added traditional dental care, indigenous perfumes, cosmetics, repellents, dye plants, yeast plants, thatching plants, fibre plants, musical instruments, as well as hunting, fishing and other technologies. It may be helpful to consider market-driven research projects separate from those with a cultural focus. The former may be of more direct value in the short term, but the latter may be more urgent and significant, because of their long term contribution towards a deeper understanding of the broader patterns of plant use in southern Africa.

Urbanisation and strong cultural influences from other parts of the world are leading to an unprecedented loss of traditional knowledge in southern Africa. Young scientists should be encouraged to grasp the opportunities presented by ethnobotanical research and to record aspects of their own cultural history and traditional plant use for the sake of future generations. It is generally accepted that knowledge changes forever once it is systematically recorded (i.e. recorded knowledge differs from oral-traditional knowledge). It is also well known that each person and each generation contextualises knowledge in a different way. A large part of what we 'discover' as scientists may actually be rediscoveries of ancient knowledge, merely presented in a modern 'sci-

entific' context. Nevertheless, the study of indigenous knowledge relating to plants and their uses should be seen as an urgent priority. Without a comprehensive and systematic reference source on indigenous plant use, there will always be an inherent flaw in the scientific knowledge of southern Africa.

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