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Indigenous plant species used by Bapedi healers to treat sexually transmitte infections: Their distribution, harvesting, conservation and threats

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ABSTRACT

An ethnobotanical survey on indigenous plant species used by Bapedi traditional healers to treat sexually transmitted infections was conducted in three districts of the Limpopo Province. Data was collected from 34 traditional healers *via* a semi-structured questionnaire, supplemented by field observations. Results showed that 37 species from 33 genera belonging to 24 families, mostly Asteraceae (10.8%), Asphodelaceae, Fabaceae and Hyacinthaceae (8.1%, each) are used to treat STIs such as chlamydia, gonorrhoea, HIV/AIDS, syphilis and other STIs (*nta* — Bapedi terminology). The vast majority (90%) of these species were harvested from communal lands. Entire plants (10.2%) and underground parts such as roots (61.5%), bulbs (10.2%) and tubers (7.6%) were mostly harvested. All species recorded in this study appear on the South African National Red Data List. These include amongst others *Cotyledon orbiculata* (near threatened), *Dioscorea sylvatica* (vulnerable), *Eucomis pallidiflora* subsp. *pole-evansii* (near threatened), *Gethyllis namaquensis* (vulnerable) and *Hypoxis hemerocallidea* (declining). Furthermore, *Boscia albitrunca*, *Elaeodendron transvaalense* and *Sclerocarya birrea* are protected under the South African National Forest Act (NFA) No. 84 of 1998. The major factors threatening indigenous species used by Bapedi healers include urban development (23%), trading and agricultural expansion (19%, each), deforestation (13%) and overexploitation (12%). This study conclude that Bapedi healers need to be informed about the conservation measures that they can implement to ensure the long term sustainability of threatened and protected species, and ultimately traditional healing as a profession.

1. Introduction

Annually, millions of people in developing countries are exposed to and possibly infected by a variety of sexually transmitted infections (World Health Organisation, 2007). These include amongst others candidal infections, chlamydia, HIV/AIDS, herpes, gonorrhoea, sores on genital parts and syphilis (Mårdh, 2004). Studies by Ndubani and Höjer (1999), Kambizi and Afolayan (2001), Ssegawa and Kasenene (2007), Namukobe et al. (2011), Maroyi (2011) and Muthee et al. (2011) found that a large percentage of the African population depends on herbal remedies for their primary health care requirements regarding sexually transmitted infections (STIs). The same is true of South Africa with numerous studies such as Hutchings et al. (1996), Amusan et al. (2007) and De Wet et al. (2012) highlighting this fact. In contrast to the vast body of evidence on phytomedicine used for STI's treatment in the rest of South Africa, very limited research has been conducted in the Limpopo Province. Most research in this province focussed on the VhaVenda (Mabogo, 1990; Madzibane and Potgieter, 1999; Samie et al., 2005; Tshikalange et al., 2005; Mulaudzi et al., 2011) and VaTsonga (Mashabane et al., 2001). It is therefore unfortunate that one of the most prominent ethnic groups, the Bapedi, has received very little attention regarding their *materia medica* for STIs. Like many other ethnic groups in South Africa and elsewhere, Bapedi indigenous knowledge of medicinal plant utilisation has been dominated by oral tradition. Consequently there is an urgent need to document the medicinal plant species used by them before it disappears.

To compound the loss of indigenous knowledge on the herbal medicine in developing countries is the disappearance of many valuable medicinal plant species. These species are threatened by factors that include trade, agricultural expansion, deforestation, overexploitation, urban development, high levels of poverty and an ever increasing human population (Wiersum et al., 2006). According to Mander (1998) and Botha et al. (2004), these factors render medicinal plants highly vulnerable, triggering increased scarcity and even extinction in some cases. In many African countries, for instance in Ethiopia (Yirga, 2010), Namibia (Cheikhyoussef et al., 2011) and Tanzania (Msuya and Kideghesho, 2009) one or more of these factors have severely affected local plant availability with consequences for curing a number of human ailments, including STIs. In the Limpopo Province their impact is already significant as they affect scarce red data listed and protected species such as *Brackenridgea zanquebarica*, *Eucomis pallidiflora*, *Securidaca longepedunculata* and *Warburgia salutaris* (Tshisikhawe, 2002; Moeng and Potgieter, 2011). Therefore, due to

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the above mentioned factors negatively impacting on medicinal species used by Bapedi to treat STIs, it was deemed necessary to explore and document their knowledge. Thus the focus was on the species used to treat STIs; their distribution, harvesting, conservation status and threats.

2. Materials and methods

2.1. Study area and population

The present study was conducted in 17 municipalities (Table 1) situated in three districts (Fig. 1) of the Limpopo Province. These selections of the study area were based upon the fact that the majority of people in these districts are heavily reliant on medicinal plants, and use herbal medications either alone or in combination with western medicines to treat several diseases (Semenya et al., 2012). Furthermore in these districts, the Bapedi speaking people constitute the largest ethnic group (Semenya, 2012).

2.2. Ethnobotanical information

Information was collected during January to June, from 2010 to 2012. Thirty four traditional healers, two per municipality were interviewed on, the part/s of plants used, source/distribution of plants, harvesting, traditional healer's perception on species abundance and threatening factors of plants used for the treatment of STIs.

2.3. Collection of plant material

The species were initially identified by their vernacular names. Their taxonomic identification *via* voucher specimens was done at the Larry Leach herbarium (UNIN) of the University of Limpopo. Voucher numbers of species are presented in Table 2.

2.4. Conservation status

In determining the official conservation status of indigenous medicinal plants, the information collected from the interviewed healers was compared to the National Red Data List of South Africa's plants (South Africa National Biodiversity Institute, 2012). Each species was assessed according to version 2012.1 of the International Union for Conservation of Nature (IUCN) categories and criteria (Table 2).

2.5. Data analysis

Data associated with the indigenous species were stored in Microsoft Excel 2007 and later analysed for descriptive statistical patterns that included percentages.

3. Results and discussion

3.1. Diversity of species used for STIs

A total of 37 indigenous species from 33 genera, distributed across 24 families were used by the questioned healers to treat STIs such as chlamydia, gonorrhoea, HIV/AIDS, syphilis and other STIs (*nta* — Bapedi terminology; an ailment traditionally believed to be transmitted *via* sexual intercourse). Most of the mentioned species were from the Asteraceae (10.8%), Asphodelaceae, Fabaceae, and Hyacinthaceae (8.1%, each). Although not reported to exclusively treat STIs, these families are consistently recorded as mostly used in different ethno medicinal inventories. For instance, species from the Asteraceae and Asphodelaceae are most used by Khoisan people in the Agter-Hantam, Northern Cape Province of South Africa (De Beer and Van Wyk, 2011). The Hyacinthaceae was reported to be one of the most used plant families by Xhosa people in the Eastern Cape Province, South Africa (Koduru et al., 2007). Interesting is that a number of studies (Kambizi and Afolayan, 2001; Hossan et al., 2010) focussing on STIs, reported the dominance of the Fabaceae. These studies concluded that since this family provided the highest number of species, it might be an important family for STIs. However, preference of the Asphodelaceae and Asteraceae families to treat STIs by the surveyed healers could certainly be attributed to their wide distribution range, large number of taxa and plant numbers.

Table 1
Districts and local municipalities incorporated in this study.

Capricorn District	Sekhukhune District	Waterberg District
Aganang (A)	Elias Motsoaledi (F)	Bela-Bela (L)
Blouberg (B)	Fetakgomo (G)	Lephalale (M)
Lepelle-Nkumpi (C)	Groblersdal (H)	Modimolle (N)
Molemole (D)	Makhuduthamaga (I)	Mogalakwena (O)
Polokwane (E)	Marble Hall (J)	Mookgophong (P)
	Tubatse (K)	Thabazimbi (Q)

3.2. Plant habit

The dominant growth forms harvested by Bapedi healers were herbs (48.6%), trees (40.5%) and shrubs (10.8%). These observations are partially in agreement with that noted by Moshi et al. (2009) in the Bugabo ward, Kagera Region, north western Tanzania. Their study found that trees accounted for 31%, followed by herbs (29%) and shrubs (26%). In the Cape Peninsula, Western Cape Province (South Africa), Mintsa Mi Nzue (2009) also reported almost similar results, but noted shrubs (28%), herbs (28%) and trees (19%) as dominant habitats. The distinct preference for herbs and trees in the present study reflects the ease to grow herbs and the all season availability of trees, thereby providing a continuous supply of medicinal material (Semenya, 2012). Thus it seems reasonable to conclude that the interviewed healers target growth forms that can supply medicinal materials throughout the year to ensure sustainability in the treatment of STIs.

3.3. Source of plant

3.3.1. Communal lands

Regarding the distribution of medicinal species used by the questioned healers, the vast majority (90%) were collected from communal lands. This is a common practice in the Limpopo Province (Magoro, 2008; Moeng and Potgieter, 2011) and elsewhere (Nanyingi et al., 2008; Yirga, 2010). Bapedi healers prefer communal lands because of its generally easy access. This is line with Mander (1998), who found that natural resources in communal lands are easily exploited as there is little or no control. Shackleton et al. (1995) speculated that the degradation of these lands was mostly caused by democratisation after 1994; they reasoned that the tribal authority control over land and natural resources weakened significantly resulting in the overexploitation of communal lands. Moeng (2010) recommended that communities develop management plans for collection sites, while encouraging a value system that promotes respect for the environment and sustainable utilisation of natural resources. This will result in *in-situ* conservation of plant diversity.

3.3.2. Home gardens

Bapedi traditional healers collected many of the preferred species, which were declared as threatened in the wild, and conserved them in home gardens. These included *Aloe arborescens*, *Euphorbia maleolens*, *Gethyllis namaquensis*, *Dioscorea sylvatica*, *Drimia elata*, *Hypoxis hemerocallidea*, *E. pallidiflora* and *Zanthoxylum humile*. This finding concurs with Wiersum et al. (2006) who found that in the Amatola Region, Eastern Cape Province, *D. elata* and *H. hemerocallidea* were collected from the wild and transplanted in home gardens. Cultivation of species, especially threatened ones by Bapedi healers is in

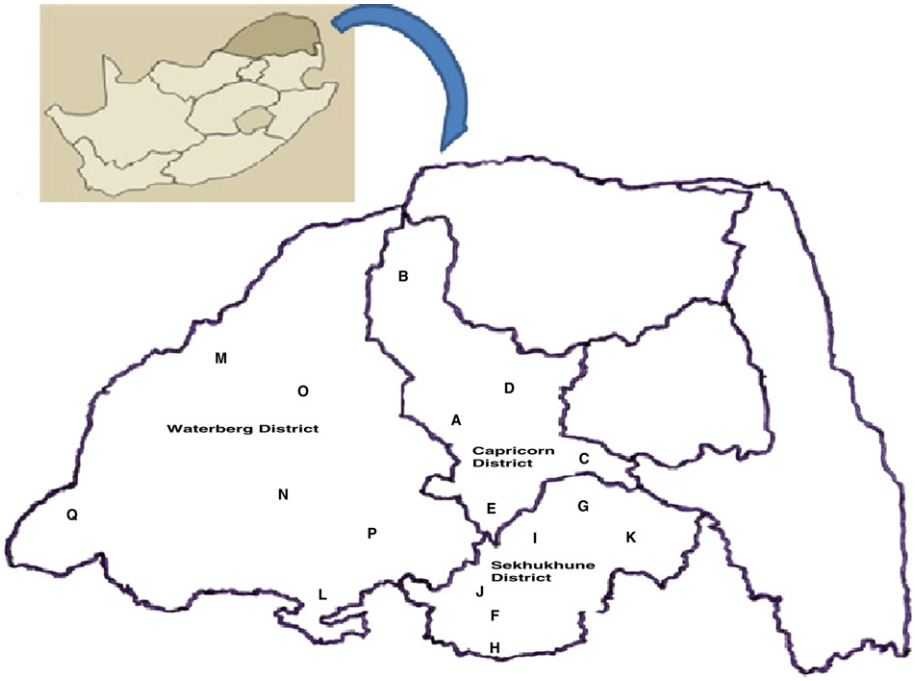

Fig. 1. Study area: Capricorn, Waterberg and Sekhukhune districts, Limpopo Province, South Africa. A–Q designates the involved municipalities.

itself a conservation measure. However, it might be a destructive effort if they conserve these species but at the same time continue to harvest them in the wild. These concerns were echoed by Wiersum et al. (2006) who noted that medicinal plant cultivation is less based on preserving biodiversity, than on generating income from them.

3.4. Plant collection

Seventy nine percent of Bapedi healers collected their own medicinal plants. This seems to be the general pattern as a number of studies have noted this trend, including Kambizi and Afolayan (2001) for the Guruve District of Zimbabwe. They noted that it is only under certain circumstances that an ordinary person could collect plants on behalf of the traditional healer. In the Samburu District, Kenya, healers prefer to collect their own plants (Nanyingi et al., 2008). According to Nanyingi et al. (2008), this practice among the healers from the Samburu District is to preserve the secrecy of species location. However, Bapedi traditional healers believe that to ensure the efficacy of the medicine, it must be collected by a person who has not had sexual intercourse for at least two days prior to collection. Thus to ensure sexual purity, healers collect their own medicinal plants. However, 21% of the surveyed healers do make use of trainees for collections, under careful instruction on the way of collecting such material.

3.5. Harvesting of plants

Modern implements such as axes, pitchforks, knives, pickaxes, spades, or almost any other sharp instrument are used by Bapedi healers to harvest plant parts. However, Naidoo and Nyakale (2000) viewed these modern day implements as much more destructive compared to ancient tools such as pointed wooden sticks and stone axes. According to Ndawonde (2006), these ancient tools with their limited effectiveness restricted the quantity of medicinal material that could be gathered over a short period of time. It is therefore logical to speculate that the use of modern tools by traditional healers has had a destructive effect on plants.

3.5.1. Methods of harvesting plants

3.5.1.1. Underground parts. These parts (roots, 61.5%; bulbs, 10.2% and tubers, 7.6%) constituted the largest portion of harvested plant parts. Bapedi healers did not re-fill the soil after removing the underground parts; claiming that re-filling of soil will worsen a patient's illness. This is in agreement with observations made by Magoro (2008). However, Kambizi and Afolayan (2006) found the opposite under the Shona of Zimbabwe; who indicated that it is a taboo not to refill the pit from which the roots are dug and that disregarding this tradition would result in worsening the sickness of the patient. The custom of not re-filling the soil after removing the underground parts might result in the destruction of water up-take by the plant, plant carbohydrate reserve depletion, nutrient flow disruption or increase susceptibility to fungal attack, which will eventually kill the plant (Botha et al., 2004).

Bapedi traditional healers harvested underground parts from trees, shrubs and herbs. It was noted that these healers did not collect roots from species previously harvested by other healers or any people. Previously harvested species was easily identified by observing the marked effect of a pit. This was practiced as they claimed that previous harvester collected roots which carried the healing power. Based on the field observation, this custom could promote sustainability in cases where small quantities of roots are removed from a single tree. However, where larger quantities of roots were removed, the survivability of the tree can be affected. This could lead to the extinction of slow-growing (Geldenhuys and Williams, 2005) and protected species (NFA, 1998) such as *Elaeodendron transvaalense*. This is equally true for large trees such as *Burkea africana* that take many years to reach maturity. The removal of large quantities of roots has been reported by Akerele et al. (1991), as the most harmful and threatening harvesting method for trees. The possibility exist that Bapedi traditional healers might continue to harvest large quantities of root from a single plant due to the scarcity of the species in the wild and increased distance to the collection site. There is an urgent need to educate them and increase awareness regarding the advantage of suitable harvesting practices and *vice versa*.

Struhsaker (1998) defined sustainable harvesting as activities involving the removal of a natural resource that does not deplete or compromise its ability to regenerate. Therefore the practice of Bapedi traditional healers to harvest underground parts from shrubs and herbs by uprooting them could be seen as an unsustainable harvesting practice. Species such as *Callilepis salicifolia*, *E. maleolens* and *Geigeria aspera* with shallow root systems were completely destroyed during harvesting. Harvesting by uprooting plants such as shrubs and herbs not only has a detrimental effect on the plant itself, but as Magoro (2008) noted it also has a marked effect on surrounding plants by affecting root systems.

3.5.1.2. Entire plant. The harvesting of the entire plant (10.2%) by Bapedi traditional healers by uprooting was observed with herbs such as *E. maleolens*, *G. aspera*, *Helichrysum caespititium* and *Myrothamnus flabellifolius*. Jansen (1981) reported that harvesting of the whole plant by uprooting is extremely destructive, and that it could further lead to the rapid extinction of a species. In the present study, the harvesting of entire plants by healers was because they intended to use all plant parts concurrently. Therefore, healers should be encouraged to harvest fewer parts or different parts from a single plant rather than uprooting the entire plant. Although this practice could be time consuming, especially when harvesting ground-spreading herbs like *H. caespititium*, it will ensure sustainability of the population. Fortunately the structure of *E. maleolens* is segmented which makes it easier to harvest in a selective manner.

3.5.1.3. Bark. Only 51% the plant parts used in this study consisted of bark, which was harvested with equipment such as axes, spades, knives or sharp instruments. Bark was exclusively harvested from trees such as *Peltophorum africanum* and *Sclerocarya birrea*. These species are also routinely harvested for their bark in other areas of South Africa (Mabogo, 1990; Ndawonde, 2006). Uncontrolled harvesting could result in their extinction, as they are slow growing with little wound recovery (Geldenhuys and Williams, 2005). However, bark harvesting practices among the Bapedi include stripping bark only from the eastern side of trees. This practice was also reported by Mabogo (1990) for VhaVenda traditional healers. Ndawonde (2006) reported bark harvesting of the above mentioned species by Zulu healers on both the east and west-facing sides of the tree trunk. It is interesting to note that Bapedi, VhaVenda (eastern side) and Zulu (east and west-facing side) traditional healers mentioned that bark harvested on those sides has more healing ingredients compared to the ones harvested on the other sides. Kambizi and Afolayan (2001) highlighted that this harvesting method prevents ring-barking and enables the tree to recover faster from wounding. Magoro (2008) indicated that rapid recovery is possible because the tree receives adequate sunlight on both eastern and western side, which plays a crucial role in the healing process.

3.5.1.4. Leaves and seeds. Bapedi traditional healers harvested seeds (2.5%) by hand picking. Leaves (2.5%) were harvested using a knife. Notably, *Aloe marlothii* leaves were selectively removed by these healers; this practice might be due to its availability throughout the year. Bapedi healers reported that previously harvested species showed signs of recovery; even though the rate of recovery was prolonged. This finding is supported by an earlier study (Ross, 2005) in the Emnambithi local municipality of KwaZulu-Natal, where it was noted that *A. marlothii* plants which have been harvested, took longer than the average 18 months to recover. As a result Ross (2005) recommended that the period between harvesting should be lengthened and closely monitored if the plants are to be harvested sustainably. The seasonal availability of *Protea caffra* seeds resulted in the harvesting of large quantities from a selected number of plants by Bapedi traditional healers. This practice will eventually impact on the survival of the species. It is therefore suggested that smaller quantities from a larger number of plants be collected, rather than as much as possible from only a few.

3.5.2. Harvesting frequency and volumes collected

Findings from this study clearly indicated that a fixed protocol as to how often medicinal plants should be collected, did not exist. Plants were collected throughout the year, and seasonality only played a role when plant parts such as fruits or leaves were to be collected. Medicinal plants were mostly collected on a monthly basis (thrice or once), only a few harvested medicinal plants twice a week (18%) and on a daily basis (2%). It was observed that healers harvested and carried as many plants as they can when they go out for collection. They mentioned that it will be a waste of time, money and energy to harvest only a few species when out for collection. When asked about this practice they reasoned that harvesting larger quantities of plants was necessary because of the increased distance they had to travel to the collection site. According to them, the scarcity of certain species also warrants the collection of larger volumes; an approach that might in the end result in the destruction of certain wild populations. In fact the harvesting frequencies adopted by the Bapedi traditional healers might raise concern, as some plants take very long to recover after parts have been harvested.

3.6. Use of species according to districts

The 37 plant species used by Bapedi traditional healers to treat bacterial STIs were not used in all three surveyed districts. Five species (*Cotyledon orbiculata*, *D. sylvatica*, *G. namaquensis*, *Hypoxis obtusa* and *P. caffra*) were exclusively used in the Capricorn District, 11 (*A. arborescens*, *E. maleolens*, *H. caespititium*, *Jatropha zeyheri*, *Kleinia longiflora*, *M. flabellifolius*, *Pelargonium* spp., *Sansevieria hyacinthoides*, *Searsia lancea*, *Triumffeta* spp. and *Z. humile*) in the Sekhukhune District, and 16 (*Aloe falcata*, *Boscia albitrunca*, *B. africana*, *Dodonaea viscosa*, *E. transvaalense*, *Elephantorrhiza elephantina*, *Euclea crispa*, *E. pallidiflora*, *G. aspera*, *H. hemerocallidea*, *Ipomoea obscura*, *P. africanum*, *Plectranthus ciliatus*, *Sarcostemma viminale*, *S. birrea* and *Zanthoxylum capense*) in the Waterberg District. The most widely used species were *A. marlothii* (Capricorn and Sekhukhune), *Senna italica* (Sekhukhune and Waterberg), *D. elata*, *C. salicifolia* and *Ziziphus mucronata* (Capricorn and Waterberg). The degree of use could be linked to a number of factors which include amongst other their distribution, abundance and/or intra cultural differences.

3.7. Conservation status of species

3.7.1. Red Data species

All species used by Bapedi traditional healers to treat STIs appear in the South African National Red Data List of plants. With the exclusion of *C. orbiculata*, *E. transvaalense* and *E. pallidiflora* (near threatened), *D. sylvatica* and *G. namaquensis* (vulnerable), *D. elata* and *M. flabellifolius* (insufficient information), *H. hemerocallidea* (declining), all species appear as least concern. However, three species (*B. albitrunca*, *E. transvaalense* and *S. birrea*) listed as least concern are also protected by the National Forest Act No. 84 of 1998. Despite being legally protected, the vulnerable *G. namaquensis* and *D. sylvatica* are exclusively used by traditional healers in the Capricorn District to treat STIs. In the Eastern Cape Province, Dold and Cocks (2002) placed *D. sylvatica* amongst the most used and traded species by Xhosa traditional healers and medicinal plant traders. These species are collected because they are perceived to work in the treatment of STIs. As a matter of fact, it is not even guaranteed that familiarity with legislation will contribute positively towards conservation of species. Indeed as Mander (1998) observed, enforcement of conservation legislation prohibiting the collection and sale of protected species has done very little to remedy the situation.

Table 2
Indigenous species used by Bapedi traditional healers to treat STIs.

Species name	Family	Voucher no	No. of citations (%)	Pedi vernacular name	Habit	Used part/s	STIs treated	Conservation status of species	
								Red data	Healers
Aloe arborescens Mill.	Asphodelaceae	SS 59	03	Kgopha-ya-fase	Herb	Root & leaf	HIV/AIDS	Least concern	Declining
Aloe falcata Baker	Asphodelaceae	SS 330	03	Kgopha	Shrub	Root	HIV/AIDS	Least concern	Fairly abundant
Aloe marlothii A. Berger subsp. *marlothii*	Asphodelaceae	SS 80	24	Kgopha-ya-go-ema	Tree	Root	Gonorrhoea & *nta*	Least concern	Fairly abundant
Boscia albitrunca (Burch.) Gilg & Gilg-Ben.	Capparaceae	SS 300	03	Mohlophi	Tree	Root	HIV/AIDS	Least concern	Rare
Burkea africana Hook.	Fabaceae	SS 60	03	Monatlo	Tree	Root	HIV/AIDS	Least concern	Rare
Callilepis salicifolia Oliv.	Asteraceae	SS 62	06	Phelana	Herb	Tuber	Gonorrhoea & HIV/AIDS	Least concern	Fairly abundant
Cotyledon orbiculata L. var. flanaganii (Schönland & Baker f.) Toelken	Grassulaceae	SS 37	03	Tsebe-ya-kolobe	Shrub	Root	Gonorrhoea	Near threatened	Fairly abundant
Dioscorea sylvatica Eckl.	Dioscoreaceae	SS 11	03	Unknown	Herb	Bulb	Gonorrhoea	Vulnerable	Near extinction
Dodonaea viscosa Jacq. var. *angustifolia* (Lf) Benth.	Sapindaceae	SS 117	03	Mofentshe	Tree	Root	HIV/AIDS	Least concern	Cultivated
Drimia elata Jacq.	Hyacinthaceae	SS 18	06	Sekanama	Herb	Bulb	Gonorrhoea & HIV/AIDS	Data Deficient	Near extinction
Elaeodendron transvaalense (Burtt Davy) R.H. Archer	Celastraceae	SS 32	03	Monamane	Tree	Root	HIV/AIDS	Near threatened	Rare
Elephantorrhiza elephantina (Burch.) Skeels	Fabaceae	SS 100	09	Mosehlana	Shrub	Root	HIV/AIDS	Least concern	Fairly abundant
Euclea crispa (Thunb.) Gürke subsp. crispa	Ebenaceae	SS 57	06	Mokwerekwere	Tree	Root	HIV/AIDS	Least concern	Fairly abundant
Eucomis pallidiflora (Baker subsp. pole-evansii (N.E.Br.)) Reyneke ex J.C. Manning	Hyacinthaceae	SS 355	03	Mathuba-difala	Herb	Bulb	Chlamydia	Near threatened	Near extinction
Euphorbia maleolens E. Phillips	Euphorbiaceae	SS 34	12	Rofa-bja-tau	Herb	Whole plant	HIV/AIDS	Least concern	Declining
Geigeria aspera Harv. var. *aspera*	Asteraceae	SS 310	03	Makgonatsohle	Herb	Whole plant	HIV/AIDS	Least concern	Fairly abundant
Gethyllis namaquensis (Schonland) Oberm.	Amaryllidaceae	SS 83	03	Naka-tsa-tholo	Herb	Bulb	Chlamydia	Vulnerable	Rare
Helichrysum caespititium (DC.) Harv.	Asteraceae	SS 78	03	Bokgatha	Herb	Whole plant	Gonorrhoea	Least concern	Fairly abundant

Hypoxis hemerocallidea Fisch., C.A. Mey. & Avé-Lall.	Hypoxidaceae	SS 115	12	Titikwane	Herb	Tuber	Gonorrhoea & HIV/AIDS	Declining	Near extinction
Hypoxis obtusa Burch. ex Ker Gawl.	Hypoxidaceae	SS 336	03	Monna-maledu	Herb	Tuber	Chlamydia	Least concern	Declining
Ipomoea obscura (L.) Ker Gawl. var. *obscura*	Convolvulaceae	SS 200	03	Kgomodimaswi	Herb	Root	Gonorrhoea	Least concern	Fairly abundant
Jatropha zeyheri Sond.	Euphorbiaceae	SS 120	03	Unknown	Tree	Root	Gonorrhoea	Least concern	Fairly abundant
Kleinia longiflora DC.	Asteraceae	SS 217	03	Lekgabolo	Herb	Root	Chlamydia	Least concern	Fairly abundant
Myrothamnus flabellifolius Welw	Myrothamnaceae	SS 111	03	Boka	Herb	Whole plant	HIV/AIDS	Data Deficient	Fairly abundant
Pelargonium spp.	Geraniaceae	SS 04	03	Selumi	Herb	Root	HIV/AIDS	Least concern	Fairly abundant
Peltophorum africanum Sond.	Rhamnaceae	SS 13	06	Mosehla	Tree	Bark & root	HIV/AIDS	Least concern	Fairly abundant
Plectranthus ciliatus E. Mey. ex. Benth.	Lamiaceae	SS 322	03	Unknown	Herb	Root	HIV/AIDS	Least concern	Fairly abundant
Protea caffra Meisn. subsp. *caffra*	Proteaceae	SS 341	03	Unknown	Tree	Seeds	Chlamydia	Least concern	Declining
Sansevieria hyacinthoides (L.) Druce	Dracaenaceae	SS 199	03	Makgotse	Herb	Root	HIV/AIDS	Least concern	Rare
Sarcostemma viminale (L.) R.Br. subsp. orangeanum Liede & Meve	Apocynaceae	SS 106	03	Mokwere-kwere- o-mogolo	Tree	Root	HIV/AIDS	Least concern	Cultivated
Senna italica Mill. subsp. arachoides (Burch.) Lock	Fabaceae	SS 321	06	Mankgane	Shrub	Root	Gonorrhoea	Least concern	Fairly abundant
Sclerocarya birrea (A. Rich.) Hochst. subsp. caffra (Sond.) Kokwaro	Anacardiaceae	SS 01	03	Morula	Tree	Bark	HIV/AIDS	Least concern	Fairly abundant
Searsia lancea (L.f.) F.A. Barkley	Anacardiaceae	SS 227	03	Mokalabata	Tree	Root	*nta*	Least concern	Fairly abundant
Triumffeta spp.	Tilliaceae	SS 64	03	Unknown	Herb	Root	HIV/AIDS	Least concern	Fairly abundant
Zanthoxylum capense (Thunb.) Harv.	Rutaceae	SS 511	03	Senokomaropa	Tree	Root	HIV/AIDS	Least concern	Rare
Zanthoxylum humile (E.A. Bruce) P.G. Waterman	Rutaceae	SS 19	06	Monokwane	Tree	Root	HIV/AIDS	Least concern	Declining
Ziziphus mucronata Wild. subsp. *mucronata*	Rhamnaceae	SS 12	12	Mokgalo	Tree	Root	Gonorrhoea & chlamydia	Least concern	Fairly abundant

Declining: A species in this category does not meet any of the five IUCN criteria and does not qualify for the categories critically endangered, vulnerable or near threatened, but there are threatening processes causing a continuing decline in the population.
Data deficient: A species is data deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status.
Least concern: A species is least concern when it has been evaluated against the criteria and does not qualify for critically endangered, endangered, vulnerable or near threatened. Widespread and abundant species are included in this category.
Near threatened: A species is near threatened when it has been evaluated against the criteria but does not qualify for critically endangered, endangered or vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Vulnerable: A species is vulnerable when the best available evidence indicates that it meets any of the criteria (a) to (e) for vulnerable (according to IUCN criteria), and is therefore considered to be facing a high risk of extinction in the wild.

The limited use of *G. namaquensis* and *D. sylvatica* in the Capricorn District might be linked to their distribution or natural occurrence as traditional healers indicated that they are difficult to find in the wild. Their continued use might result in extinction, especially with high demand and low population yield. As a consequence their use by Bapedi healers to treat STIs will be threatened.

Roots from the near threatened *C. orbiculata* were only used by traditional healers residing in the Capricorn and Waterberg districts. Other studies (Thring and Weitz, 2006; De Beer and Van Wyk, 2011) in South Africa clearly indicate that different parts of *C. orbiculata*, excluding roots, are extensively used to treat various diseases, excluding STIs. Field observations in this study revealed that the collection of *C. orbiculata* roots in both districts is indiscriminate, without any consideration of size and age. This behaviour might indeed contribute to this species becoming extinct. The widespread use of different parts of *C. orbiculata* across South Africa also indicates that its population is under severe pressure of over exploitation. Substitution of *C. orbiculata* with species that are still fairly abundant in the wild should be an important strategy for its conservation and Bapedi traditional healers should be encouraged to consider this strategy.

In this study the majority of near threatened species used to treat STIs were in abundance in the Waterberg District. These species included slow growing *E. pallidiflora* which was used to treat chlamydia (Koduru et al., 2007) and the protected *E. transvaalense* which was used to treat HIV/AIDS (NFA, 1998). These species were both noted by Moeng (2010) as highly traded for treating HIV/AIDS and as blood purifiers, and unsustainably harvested in the Waterberg District. The high prevalence of HIV/AIDS (Johnson et al., 2008) will definitely increase their current harvesting and uses in this district, which may eventually extirpate population densities in communal areas. In addition to this, underground parts, such as bulbs and roots were unsustainably collected by Bapedi from these species. For instance, harvesting of *E. pallidiflora* was by uprooting, a technique which causes immense damage. The most vulnerable species are the popular, slow-growing and reproducing species, including but not limited to species such as *D. elata* (data deficient), with specific habitat requirement and a limited distribution (Cunningham, 1992). *D. elata* was exclusively collected by traditional healers from the Capricorn and Waterberg districts. They collected it from wetlands and transplanted it to their home gardens. This species is easily located in communal areas and the main concerns are overexploitation and destructive harvesting of the underground (root, bulb, tuber) parts (Marshall, 1998; Linder et al., 2000), or even the plant as a whole (Cunningham, 1991).

In a similar fashion, tubers of *H. hemerocallidea*, a species listed as declining, was exclusively used by traditional healers from the Waterberg District, to treat gonorrhoea and HIV/AIDS. Ndawonde (2006) found that this species was also popular with the Zulu for treating HIV/AIDS. The harvesting protocol of *H. hemerocallidea* by traditional healers, *i.e.* removal of the whole plant, could put the species under tremendous pressure in the near future. Today there is a wide range of *H. hemerocallidea* extracts available in pharmacies, health shops and supermarkets in South Africa to help manage HIV/AIDS. These include Moducare® (Immune booster), Hypo-Plus® (energy booster and food supplement), capsules and tablets consisting of the whole *H. hemerocallidea* herb (Drewes and Khan, 2004). All of these products indicate that this species is being overexploited and might face extinction in nature. Parallels can be drawn between the prevalence of a disease and the phytomedicine employed. The current scenario presents unique challenges to conservation agencies for sustainable management of these species.

Three protected species (NFA, 1998); *B. albitrunca*, *E. transvaalense* and *S. birrea*, are used by Bapedi traditional healers in the Waterberg District. These species were also reported by Mabogo (1990) and Tshisikhawe (2002) as used medicinally by Venda traditional healers. As indicated previously, enforcement of conservation legislation prohibiting the collection and sale of protected species has done little to remedy the situation (Mander, 1998). Bapedi traditional healers can't differentiate between protected and unprotected species, therefore educating them in terms of protected species and research into sustainable harvesting is imperative.

3.7.2. Red Data species vs healer's perception of their abundance

A total of 54% of indigenous species were mentioned by Bapedi traditional healers as still fairly abundant in the wild (Table 2). It is interesting that all of these species appear as least concern in the South African National Red Data List of plants. According to SANBI (2012), more widespread and abundant species in the wild are included in this category. It is paramount that traditional healers are included in any initiative focussing on the sustainable utilisation of this resource.

C. orbiculata (near threatened) and *M. flabellifolius* (insufficient information) were declared by traditional healers as still fairly abundant in the wild. A similar situation where local resource users perceived threatened species as abundant was reported by Loundou (2008) in the Western Cape Province. This could be a reflection of local distribution patterns, which are not reflected in the Red Data List, thus clearly illustrating the need for conservation to be adapted to accommodate local distribution patterns. A similar trend was observed with other species, where a disjunction existed between healers' perception and the Red Data List (Table 2).

Bapedi traditional healers reported that *D. sylvatica*, *D. elata*, *E. pallidiflora* and *H. hemerocallidea* were on the verge of becoming extinct in communal areas. *H. hemerocallidea* was previously mentioned by healers residing in the Magatle and Klopper villages to be in danger of extinction in the wild due to unsustainable harvesting (Magoro, 2008). *D. elata* was reported by “coloured” (mixed-raced) traditional healers and society as very hard to find due to its high demand and the threat from increasing agriculture and habitat destruction (Thring and Weitz, 2006). In an effort to increase their availability and to prevent overexploitation in the wild Bapedi traditional healers claim to cultivate these species in home gardens.

Shanley and Luz (2003) reported that familiarity with your natural environment makes you aware of the status of your resources long before conservationists detect it. Thus Bapedi traditional healers need to be key partners for effective conservation and management of valuable medicinal plants prone to over-harvesting and subject to other threats. More research on medicinal plant utilisations by them and their perception regarding plant availability would contribute to a better understanding of their conservation status.

3.8. Factors threatening medicinal species

3.8.1. Urban development

The majority (23%) of the Bapedi traditional healers indicated that urban development is a threat to indigenous plant species used by them to treat STIs. Healers in the Modimolle local municipality (Waterberg District), indicated that the construction of Reconstruction and Development Programme (RDP) houses destroyed large populations of medicinal plants. Similarly in the Bela-Bela and Mookgophong municipalities, also from the Waterberg District, it was mentioned that the construction of factories as well as the expansion of residential sites, destroyed many wild populations of medicinal plants.

Similar threats were reported by traditional healers residing in the Elias Motsoaledi, Groblersdal and Marble Hall municipalities (Sekhukhune District), and all surveyed municipalities in the Capricorn District. These findings are partially in agreement with those reported by Khorombi (2002) in Tshivhase area, Vhembe District. This study noted that human settlements and the development of roads have destroyed many of the indigenous medicinal species used by local communities. Wynberg (2002) concluded that urban development is one of the major threats to biodiversity in South Africa. This is not a uniquely South African phenomenon as an earlier study by Caniago and Siebert

(1998) reported that urban development in Indonesia placed significant pressure on native medicinal plant species.

Communal lands in the Modimolle and Mookgophong municipalities are mainly delimited by huge private farms, and protected areas. This in itself limits human movement and access to medicinal plants. It was therefore not surprising that traditional healers from these municipalities viewed such protected areas as a threat to their practice. It is recognised that in future urban development will result in more land cleared for development purposes. As a result communal land will become smaller and this will result in the decreased availability of many medicinal plants, ultimately impacting on the practice of traditional healing in these areas. Traditional healers in these affected areas should be encouraged to (i) grow medicinal plants in home gardens, and (ii) legally obtain access to protected areas for plant collection.

3.8.2. Medicinal plant trading and agricultural expansion

The second most threats to medicinal plants were plant trading and agricultural expansion (19% each).

3.8.2.1. Medicinal plant trading. Trading of medicinal plants is a common threat to the biodiversity in South Africa, and is mainly the result of poverty, high population densities, uncontrolled access, and destructive and unsustainable harvesting methods (Twine et al., 2003). In the Limpopo Province, Moeng and Potgieter (2011) noted that harvesting by medicinal plant traders is both destructive and unsustainable. Harvesting of underground parts of *E. pallidiflora* (bulb) and *H. obtusa* (tuber) was by uprooting. Furthermore, it is worthwhile to note that these species were amongst the eight most traded in the Capricorn, Sekhukhune and Waterberg districts. Based on Moeng's (2010) finding, it is not surprising that Bapedi traditional healers reported a number of species, such as *D. sylvatica*, *H. hemerocallidea* and *E. pallidiflora* as near extinct in the wild. To 2further highlight the impact of trading on these medicinal species in other parts of South Africa, Williams et al. (2000) noted *Hypoxis* species as highly traded and unsustainably harvested in the Witwatersrand and KwaZulu-Natal. *D. sylvatica* (vulnerable) were amongst the most commonly sold and unsustainably harvested plants in the Eastern Cape Province (Dold and Cocks, 2002). Mintsa Mi Nzue (2009) found *D. sylvatica* to be part of the daily ingredients used in the preparation of different remedies by Xhosa traditional healers in the Western Cape Province. In an attempt to control medicinal plant trading in the studied districts and the Limpopo Province as a whole, conservation authorises, tribal authorities and local communities must enter into a partnership (Moeng and Potgieter, 2011). An agreement should be established, which decrees that benefits from proper management of the permit system would flow commensurately to all partners (Damn, 2002). Furthermore, plant part substitution (Zschocke et al., 2000) and cultivation of threatened species (Cunningham, 1992) and most popular species should be an important strategy for their conservation.

3.8.2.2. Agricultural expansion. Equal to the trade in medicinal plants, 19% of Bapedi traditional healer indicated that agricultural expansion is a major threat to medicinal species used to treat STIs. Agricultural development is a significant threat to traditional medicine in South Africa (Cunningham, 1991; Thring and Weitz, 2006) and other parts of Africa (Lulekal et al., 2008; Yineger et al., 2008). In Africa the dependency on agricultural activities results in the destruction of natural forest, and consequently depletion in the availability of many species of medicinal value. The impact of agricultural expansion has already led to the scarcity of different medicinal species, for example the clearing of land for subsistence farming in Maputaland, KwaZulu-Natal has caused local extinction of *W. salutaris* (World Wildlife Fund, 2007). This is an important species used to treat a variety of ailments such as STIs, dry cough (Kubo et al., 1976), colds, chest infections, sinusitis (Rabe and Van Staden, 2000), malaria, stomach ulcers and toothache (Mashimbye et al., 1999). In Ekiti State, Nigeria, the expansion of agricultural land has led to a scarcity in species such as *Haxelobus monopetalus* and *Opuntia dillenii*, which are used by local traditional healers to treat STIs (Kayode and Kayode, 2008). Recently Birhane et al. (2011) proposed that, awareness campaigns are required to improve local community's knowledge on the importance and management of medicinal plants. A similar approach might prove beneficial to the conservation of Bapedi indigenous knowledge.

3.8.3. Deforestation

Allen and Barnes (1985) defined deforestation as the cutting down of trees for a variety of purposes such as firewood and building materials. Only 13% of the participants in this study indicated that deforestation is a threat to wild populations of medicinal species. Deforestation is one of the greatest challenges facing biodiversity in the studied districts of the Limpopo Province. This is because the majority of people rely on natural areas to meet their different needs including materials for constructions of shelters. For example, Makhado (2007) found that a mean volume of 1.360 m^3 poles was used for the construction of a single hut, 0.436 m^3 for a medium granary constructed outside the hut, 7.221 m^3 for fencing a homestead and 27.677 m^3 for a large cattle kraal. To cover their daily energy needs, most households in the Capricorn, Sekhukhune and Waterberg districts resort to freely available fuel wood. Other direct causes of deforestation in these districts include the clearance of communal areas for cattle-raising and urbanisation. Since the majority of the Bapedi traditional healers source their medicinal plants from public areas, deforestation will have a detrimental effect on the primary health care delivery system in these districts. Important plant species will be lost to deforestation unless urgent measures are taken. Studies by Cunningham (2001) and Hamilton et al. (2006) reported deforestation as one of the factors that can make a species vulnerable. For sustainable and long term conservation of medicinal plants, Bapedi traditional healers must grow them in home gardens. This will, according to Wiersum et al. (2006), ensure the continued supply of medicinal plants for traditional healing, thereby ensuring sustainability of Bapedi traditional healing practice.

3.8.4. Overexploitation

Twelve percent of traditional healers in this study acknowledged that wild medicinal species used in the local health traditions are gradually becoming extinct due to overexploitation. This is because wild medicinal plants are regarded as common property (Vorster, 1999). In the Eastern Cape Province the impact of overexploitation on medicinal species was reported by Koduru et al. (2007). They noted *Eucomis autumnalis* and *Scilla natalensis* to be particularly threatened by overexploitation an observation supported by Xhosa traditional healers. In the same province Wiersum et al. (2006) reported that the overexploitation; of underground parts and its concomitant increased use have threatened species such as *D. sylvatica*, *D. elata* and *H. hemerocallidea*. These species were reported by Xhosa healers and community members to be scarce at collection sites. These studies support the perception of Bapedi traditional healers that medicinal species are threatened by overexploitation.

According to Cunningham (1991) and Taylor et al. (2001), large parts of the common daily utilised medicines in South Africa are still derived from plants, and large volumes of plants or their extracts are sold in informal and commercial sectors of the economy. However, harvesting remains indiscriminate, destructive and unsustainable, and a shift from subsistence to income generation harvesting accelerates the overharvesting of medicinal plants. To address the issues of overexploitation, thereby improving the socio-economic status of communities and the benefits to conservation (Damn, 2002) the following is proposed; the requirements regarding the sustainable harvesting of medicinal plants are included in a collaborative community-based

natural resource management plan, and that this plan then be implemented in partnership with stakeholders and relevant agencies.

4. Conclusions

Indigenous plant species play as important role in the Bapedi traditional primary health care sector to treat STIs. However, the use of protected and threatened species by these healers needs urgent attention. They need to be informed regarding the status of these species as they seemed to be unaware which ones are threatened or protected by law. Furthermore, a number of the species used by them are becoming declining, rare and near extinct in the wild, due agricultural expansion, deforestation, medicinal plant trading and overexploitation. However, it was noted that current harvesting techniques by Bapedi healers also add to the decline in availability of these species in the study area, indicating a need for intervention by nature conservators concerning sustainable harvesting techniques.

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