

Full Length Research paper

# Ethnobotanical survey of medicinal plants used by Bapedi traditional healers to treat erectile dysfunction in the Limpopo Province, South Africa

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Accepted 17 April, 2012

To conduct an inventory of medicinal plants commonly used by Bapedi to treat erectile dysfunction (ED), 34 healers from 17 municipalities were interviewed during the first half of 2011. These municipalities covered Capricorn, Sekhukhune and Waterberg districts located in the Limpopo Province of South Africa. A total of 21 plant species belonging to 15 families, mostly from the Apocynaceae, Asteraceae, Celastraceae, Fabaceae, Hyacinthaceae and Hypoxidaceae (9.5% each), were used to treat ED. The most frequently used species were *Zanthoxylum humile* (38.2%), *Catha edulis* (32.3%), *Ozoroa sphaerocarpa* (26.4%), and *Hypoxis hemerocallidea* (20.5%). Roots (58.3%), bulbs and tubers (12.5% each) were mostly preferred for medicine. These parts were prepared by boiling (61.9%) and pounding (38%). They were mostly taken orally (95.2%) for a period of one week or until symptoms of erectile dysfunction disappears. Although the majority of the species noted in this study has been validated either through their extensive use by various cultures, or by scientific studies, *Ammocharis coranica*, *Artemisia annua*, *Ceropegia purpurascens* subsp. *purpurascens*, *Gomphocarpus fruticosus* subsp. *fruticosus*, *Jatropha curcas*, *Ozoroa sphaerocarpa* and *Zanthoxylum humile* are noted for the first time in the treatment of ED.

**Key words:** Bapedi traditional healers, erectile dysfunction, ethnobotanical survey, medicinal plants.

## INTRODUCTION

Erectile dysfunction (ED) is sometimes referred to as impotence (Rance et al., 2003). It is one of the most distressing conditions a man can experience. Erectile dysfunction is defined by the National Institutes of Health (1993) as the inability to achieve and maintain an erection sufficient to permit satisfactory sexual intercourse. Roper (2001) defines ED as the total inability to achieve erection, an inconsistent ability to do so, or a tendency to sustain only brief erections (premature ejaculation). According to Kandeel et al. (2001), ED affects men worldwide with implications that go far beyond sexual activity alone. It is an important public health problem that compromises the overall quality of life

of the patients and their sexual partners (Althof, 2002).

Erectile dysfunction reduces self-esteem, compromising well-being and limiting interpersonal relationships (Rendell et al., 1999). This consequently leads to loss of emotional and physical intimacy and at times to divorce (Wagner et al., 2000). Other possible risk factors associated with ED include chronic diseases, such as atherosclerosis, heart diseases, hypertension, diabetes mellitus (DM), depression and renal failure (McCulloch et al., 1980). Life style factors such as cigarette smoking and excessive alcohol consumption are also linked to ED (Becher and Glinas, 2002).

About 322 million men worldwide are projected to develop ED by the year 2025, with the largest projection increases expected in Africa, Asia and South America (Aytac et al., 1999). In this regard, Africa is projected to have the highest percentage increase in ED of 169% from 1995 to 2025 (Aytac et al., 1999). As to confirm this

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expected trend, Amidu et al. (2010) found that nearly 74.4% of interviewed patients are affected by ED in Ghana. Surveys conducted by Levinson et al. (2003) in various sites scattered throughout rural and urban areas of South Africa, revealed that 48.7% of men are suffered ED. Furthermore, De Klerk and De Villiers (2003) reported that of 730 males black and mixed race male sampled from the general public in Western Cape Province of South Africa, 76.4% black men and 77.7% mixed race men suffered from ED.

In the Limpopo Province of South Africa, no information regarding the prevalence of ED could be located. However, data from the South African Medical Research Council on estimates of provincial mortality (Bradshaw et al., 2000), indicated that ailments (DM, depression, heart disease and hypertension) associated with ED are amongst the leading cause of mortality in all races in the Limpopo Province. According to Melman and Gingell (1999) these diseases are associated with ED either directly or as a consequence of their treatment.

The treatment of ED involves more than one regimen (Jequier, 2000). First line oral therapy for ED includes phosphodiesterase type-5 (PDE-5) inhibitors such as Sildenafil Citrate (Viagra<sup>®</sup>), Phentolamine (Regitine<sup>®</sup>), Verdenafil (Levitra<sup>®</sup>) and tadalafil (Cialis<sup>®</sup>) (Brindley, 1983; Vickers and Satyanarayana, 2002; Montorsi et al., 2006; Wespes et al., 2006). However, most of these drugs and treatments have limited efficacy, unpleasant side effects and contra-indications in certain disease conditions (Singh, 2011). Viagra<sup>®</sup> is a successful drug that modifies the hemodynamics in the penis (Segraves, 2003; Levinson et al., 2003). However, it was reported by Lue (2000) to have side effects such as headache, flushing, dyspepsia and nasal congestion. Furthermore according to National Institutes of Health (2003), Viagra<sup>®</sup> is not compatible in some men; it works in less than 70% of men with various etiologies.

Modern medications available for ED treatment in men are too expensive for most rural inhabitants of developing countries (Kamatenesi-Mugisha and Oryem-Origa, 2005). Yet, in traditional medicine, several species have been relied on to treat ED (Kamatenesi-Mugisha and Oryem-Origa, 2005), which have been shown to be both effective, safe (Adimoelja, 2000), and with minimum side effects (Pallavi et al., 2011). In South Africa, there is no ethnobotanical study that focused on the use of medicinal plants to manage ED. Studies such as Arnold and Gulumian (1984), Mabogo (1990) and Van Wyk et al. (1997) do highlight that traditional healers and people in South Africa use medicinal plant to manage ED. This is a first detailed report on species used exclusively to manage ED in the Limpopo Province.

## MATERIALS AND METHODS

### The study area

The present study was carried out in 17 local municipalities (Table 1)

of the Limpopo Province, covering three of the five districts (Capricorn, Sekhukhune and Waterberg) that constitute the Limpopo province (Figure 1). The majority of people in the study area belong to the Bapedi ethnic group. This ethnic group is one of the largest in the Limpopo Province, comprising about 57% of the population of the province (Limpopo Provincial Government, 2012). The people of the study area use herbal medications either alone or in combination with orthodox medicines for the treatment of several diseases. A majority of the people in the area are rural dwellers; hence the use of plants for the treatment of common diseases, such as ED is very common.

### Ethnobotanical survey

A reconnaissance survey was done in each local municipality to: (i) obtain permission to conduct this study within their area of jurisdiction, and (ii) to meet with the traditional healers to request them to participate in the study. Information was collected from January 2011 to July 2011. Semi-structured interviewees, observation and guided field walks with traditional healers were employed to obtain ethnobotanical data.

The questionnaires were completed by each of the 34 traditional healers selected from 17 local municipalities. In each local municipality two traditional healers were randomly selected and the objective of the study was explained in Sepedi, the local language. Interviews were designed to gather data on the plant species used to treat ED, methods of preparation, administration of medicine and diagnoses of ED. Field Observations were made on the morphological features and habitats of each medicinal plant species in the field. Based on ethnobotanical information provided by traditional healers, voucher specimens (Table 2) were collected for identification at the University of Limpopo's Larry Leach herbarium.

## RESULTS AND DISCUSSION

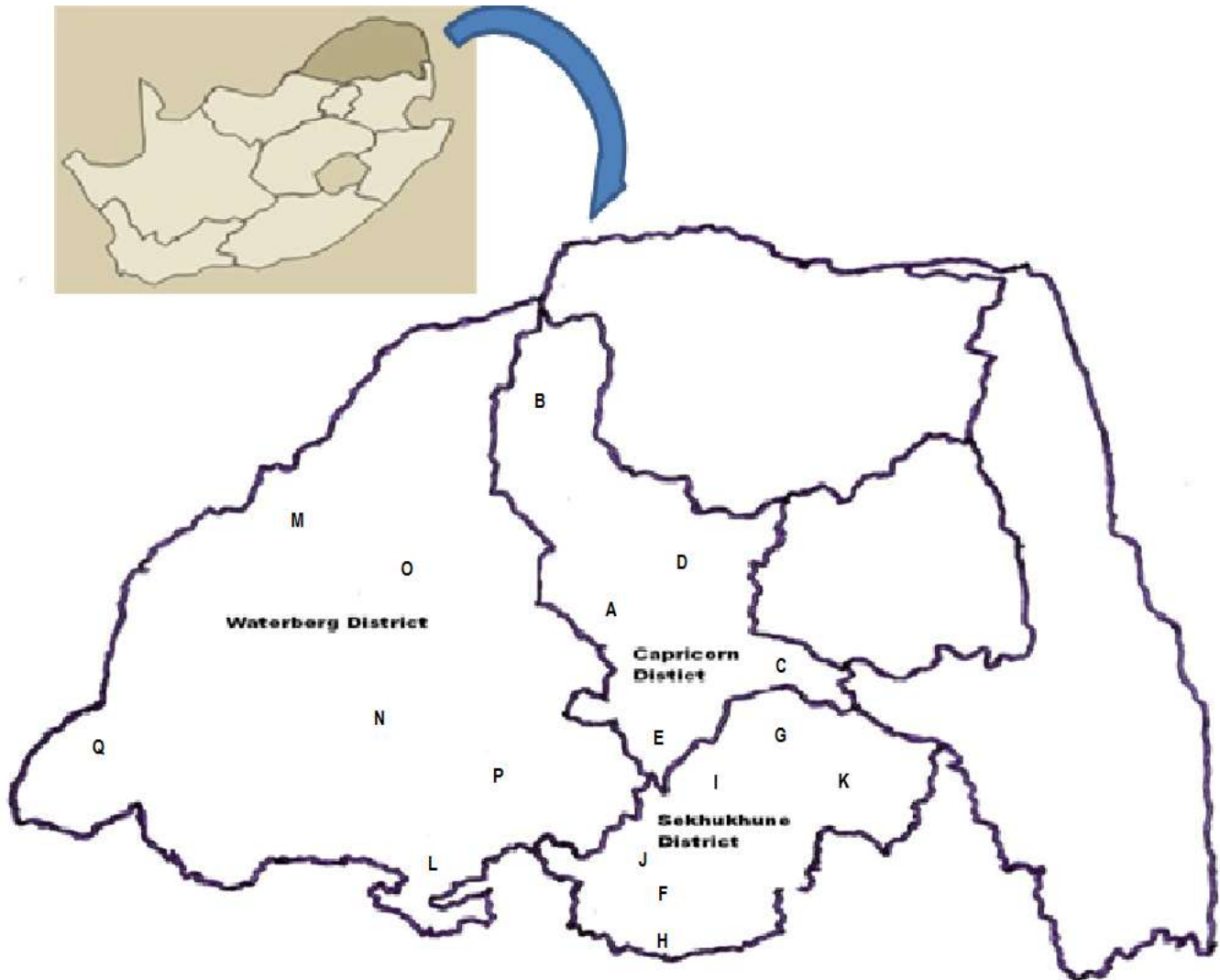
### Diversity of medicinal plants

The present study provides baseline data on the use of medicinal plants by Bapedi traditional healers to treat ED. The results revealed that 21 plant species belonging to 20 genera from 15 families are currently being used by Bapedi healers in the treatment of ED (Table 2). The number of species employed in the treatment of ED clearly reflects the diversity of treatment protocols used by Bapedi traditional healers.

Families represented with the highest number of species were Apocynaceae, Asteraceae, Celastraceae, Fabaceae, Hyacinthaceae and Hypoxidaceae (9.5% each). Although the active chemical compounds (and their modes of action) of the surveyed species are unknown, it is plausible that the identified plant families contain bioactive secondary metabolites that work against ED or related diseases. For example, previous studies reported that species from Apocynaceae (Sharma, 1960; Principe, 1989), Asteraceae (Zepeda et al., 2009), Fabaceae (New, 1984), Hypoxidaceae (Bose et al., 2008) contains aphrodisiac potentials that helps in the management of ED. Furthermore, the species from families Asteraceae (Thring and Weitz, 2006), Fabaceae (Jeyachandran and Mahesh, 2007) and Hypoxidaceae (Oyedemi et al., 2009) are often used to treat DM, a

**Table 1.** Districts and local municipalities included in this study.

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



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

chronic disease that have linkage to ED (Dey et al., 2002). In contrast, Kamatenesi-Mugisha and Oryem-Origa (2005) in the Western Uganda noted the Alliaceae, Caesalpinaceae, Euphorbiaceae, Mimosaceae, Papilionaceae and Rubiaceae families as most represented in terms species used to treat ED.

**Source of plants and conservation**

Most (90.4%) species used by Bapedi traditional practitioner were harvested from the communal land, while 9.6% usage of wild and cultivated plants were grown in home gardens. This is common practice as

**Table 2.** Medicinal species used, plant parts used in the extract preparation and administration by Bapedi healers.

Family and species name	Vernacular name	Voucher	Percentage of citations	Part/s used	Preparation and administration
Amaryllidaceae					
<i>Ammocharis coranica</i> (Ker Gawl.) Herb.	Unknown	SS 201	3	Root	Boiled for 10 min
Anacardiaceae					
<i>Ozoroa sphaerocarpa</i> R. Fern. & R.Fern.	<i>Momoko</i>	SS 30	26	Bark	Pounded and taken with soft porridge
Apocynaceae					
<i>Ceropegia purpurascens</i> subsp. <i>purpurascens</i>	<i>Monamela</i>	SS 39	3	Root	Boiled for 10 min
<i>Gomphocarpus fruticosus</i> subsp. <i>fruticosus</i>	<i>Motsotsa poo /thaka</i>	SS 101	15	Root	Boiled for 15 min
Asteraceae					
<i>Artemisia annua</i> L.	<i>Mohlatswa patla</i>	SS 43	3	Root	Boiled for 20 min
<i>Callilepis laureola</i> DC.	<i>Phela</i>	SS 62	3	Tuber	Boiled for 5 min
Celastraceae					
<i>Gymnosporia senegalensis</i> (Lam.) Loes.	<i>Mophato</i>	SS 79	15	Root and leaf	Boiled for 20 min
<i>Catha edulis</i> (Vahl) Forssk. ex Endl.	<i>Lewane</i>	SS 77	32	Root	Boiled for 5 min
Caricaceae					
<i>Carica papaya</i> L.	<i>Mophopho "wapoo"</i>	SS 70	12	Root	Pounded and taken with soft porridge
Euphorbiaceae					
<i>Jatropha curcas</i> L.	<i>Sehlare sa banna</i>	SS 120	3	Root	Boiled for 5 min
Fabaceae					
<i>Elephantorrhiza elephantina</i> (Burch.) Skeels	<i>Mosehlana</i>	SS 100	3	Root	Boiled for 10 min
<i>Peltophorum africanum</i> Sond.	<i>Mosehla</i>	SS 13	12	Bark	Pounded and taken with warm water
Hyacinthaceae					
<i>Drimia elata</i> Jacq.	<i>Sekanama</i>	SS 18	6	Bulb	Boiled for 5 min
<i>Eucomis pallidiflora</i> subsp. <i>pole-evansii</i>	<i>Mathuba difala</i>	SS 355	6	Bulb	Boiled for 5 min
Hypoxidaceae					
<i>Hypoxis hemerocallidea</i> Fish., C.A. Mey. & Ave-Lall.	<i>Titikwane</i>	SS 115	21	Tuber	Boiled for 5 min
<i>Hypoxis obtusa</i> Burch. ex Ker Gawl.	<i>Monna maledu</i>	SS 336	12	Tuber	Pounded and mixed with <i>E. pallidiflora</i> (bulb) taken with warm water

Table 2. Contd.

Myrothamnaceae						
<i>Myrothamnus flabellifolius</i> Welw.	<i>Tsoga/ Makgonatsohle</i>	SS 111	9	Whole plant	Pounded and taken with warm water	
Polygalaceae						
<i>Securidaca longepedunculata</i> Fresen. var. <i>longepedunculata</i>	<i>Mopesu</i>	SS 7	3	Root	Pounded and mixed with <i>Z. humile</i> (pounded root) and taken with soft porridge	
Rosaceae						
<i>Prunus persica</i> (L.) Batsch var. <i>persica</i>	<i>Moperekisi</i>	SS 84	9	Root	Pounded and taken with soft porridge	
Rutaceae						
<i>Zanthoxylum humile</i> (E.A.Bruce) P.G. Waterman	<i>Monokwane</i>	SS 19	38	Root	Pounded and taken with soft porridge or warm water	
Santalaceae						
<i>Osyris lanceolata</i> Hochst. & Steud.	<i>Mphera</i>	SS 61	12	Root	Boiled for 10 min	

witnessed in South Africa (Thring and Weitz, 2006), Uganda (Tabuti et al., 2003) and South America (Shanley and Luz, 2003). The practice of Bapedi traditional healers harvesting medicinal plants from communal land relates to the generally easy access to natural resources. Unfortunately, natural resources in communal lands are exploited with little or no control (Mander, 1997). Consequently most of the species become rare or extinct in these lands.

Some (15.7%) of species from a communal land used by Bapedi healers appear on the South African National Red Data List of plants (SANBI, 2001). These include *Drimia elata* (data deficient), *Eucomis pallidiflora* subsp. *pole-evansii* (near threatened), and *Hypoxis hemerocallidea* (declining). These species, as noted by traditional healers are either declining, rare or extinct in the wild, and are increasingly being cultivated in home gardens. The planting of threatened species in home gardens is a common practice amongst

traditional healers of other ethnic groups in South Africa (Wiersum et al., 2006; Ndawonde, 2006). This practice could be viewed as a conservation measure that helps to reduce harvesting pressure on indigenous wild species.

The naturalised exotics *Carica papaya* and *Prunus persica* are extensively cultivated by Bapedi healers in home gardens. These plants also serve as food during certain times of the year. Thus their dual use might provide salvation from over harvesting (Magoro, 2008) and excessive trading (Tshisikhawe, 2002; Moeng, and Potgieter, 2011) of indigenous species; traits that are common in the Limpopo Province, and the rest of South Africa (Loundou, 2008).

#### Use of species according to districts

Of 21 plant species documented in this study to treat ED, 16 are used in the Capricorn district, 14

in the Waterberg district and 11 in the Sekhukhune district. The most widespread were *Catha edulis* and *Gomphocarpus fruticosus* subsp. *fruticosus*, *H. hemerocallidea* and *Zanthoxylum humile*, which are used in all three districts. *Carica papaya* (Capricorn and Sekhukhune), *H. obtusa* (Sekhukhune and Waterberg), *Myrothamnus flabellifolius* (Capricorn and Waterberg), *Peltophorum africanum* (Sekhukhune and Waterberg) and *Ozoroa sphaerocarpa* (Capricorn and Sekhukhune), were used in two of the three districts, while all other species were used only in one district. The degree of use could be linked to their distribution, abundance and/or intra cultural differences; an aspect that warrants further investigation.

#### Inventory of selected medicinal species

The most frequently used species for ED by Bapedi

traditional healers were *Zanthoxylum humile* (38.2%), *Catha edulis* (32.3%), *Ozoroa sphaerocarpa* (26.4%), and *Hypoxis hemerocallidea* (20.5%). Comparison of the information on traditional use of these plants with ethnobotanical studies conducted in parts of South Africa and in other parts of the world show different results for many species. With the exception of *C. edulis* (Kamatenesi-Mugisha and Oryem-Origa, 2005), none of the above mentioned species have previously been reported in the treatment of ED. It is worth noting that an extract of *C. edulis*, at the dose of 100 mg/kg, reduced mounting and intromission latencies, thereby enhancing sexual motivation/arousal in male rats after 15 days of treatment (Abdulwaheb et al., 2007).

A tuber of *H. hemerocallidea* was previously reported by Erasto et al. (2005) as well as Cocks and Dold (2006) as a remedy for DM. This chronic disease is known to be prevalent to men suffering from ED (Dey et al., 2002); possibly a linkage exists between these two ailments. No literature could be found on the use of *C. papaya* to directly treat ED in South Africa. However, Jiofack et al. (2010) reported its use to treat an ailment (hypertension) associated with ED (Giuliano et al., 2004) in Cameroon. Therefore it would be reasonable to postulate that some of the medicinal species used by Bapedi traditional healers also treat the symptoms or diseases that are more common in ED patients. Nevertheless, these species need to be substantiated with phytochemical and pharmacological studies in order to corroborate their bio-efficacy for ED.

Very few of the medicinal species used by Bapedi healers have been validated through scientific research. One of those, *Securidaca longepedunculata* has through *in vitro* bioassays demonstrated high aphrodisiac activity (Rakuambo et al., 2006; Sumalatha et al. 2010). Although this species is protected under the South African National Forest Act no: 84 of 1998, its harvesting and trade in the Vhembe district of the Limpopo Province (Tshisikhawe, 2002) as a remedy treating ED has continued to be indiscriminate and destructive (Baloyi et al., 2012).

A number of species used by Bapedi traditional healers in the treatment of ED have been validated via their extensive use by various cultures in South Africa and other parts of Africa. For instance, the Vha-Tsonga people of the Limpopo Province use both *D. elata* and *H. obtusa* as an aphrodisiac (Moeng and Potgieter, 2011). The utilization of *Callilepis laureola* by Zulu healers of KwaZulu-Natal Province of South Africa to treat ED was noted earlier by Seedat and Hitchcock (1971). *Elephantorrhiza elephantina* is used by the Shona people of Zimbabwe to treat ED (Gelfand et al., 1985). Mutheea et al. (2011) reported *Osyris lanceolata* as one of the most important species used by Maasai healers in Kenya to treat ED. The observed similarities between Bapedi traditional healers and healers of these other ethnic groups in terms of species used are significant. This is because identical plant use by different people from

different areas may be a reliable indication of curative properties.

Although *A. coranica*, *A. annua*, *G. fruticosus* subsp. *fruticosus* and *J. curcas* are exotics in South Africa, from a conservation point of view these species may assist in reducing pressure of harvesting indigenous wild species with similar uses. However, this should be viewed as a short term solution as these species could become naturalised or invasive in the long term through their continued use.

## Diagnosis

Bapedi traditional healers diagnose ED based on symptomatic presentation. This is because they do not have access to laboratory results to guide diagnosis and treatment, or they shy away from written information due to their illiteracy skills. Importantly, communication prior to diagnosis between Bapedi healers and their patients is very deep. Before commencement of the treatment, Bapedi healers closely observe the condition of their patient and request information about prevailing symptoms (Table 3). Low sex drive was the most commonly cited diagnostic criteria, followed by a weak erection. It is interesting to note that both low sex drive and weak erection could possibly be linked ED.

Bapedi traditional healers depended on the patients' testimony to determine treatment success. A similar practice was reported by Kamatenesi-Mugisha and Oryem-Origa (2005) and Bhattarai et al. (2010). However, some Bapedi healers claimed that their ancestors confirmed the effectiveness of their herbal prescriptions. This claim was expected as most of African healers believe that the ancestors have a positive influence on herbal prescriptions (Chavunduka, 1994). The disappearance or the improvement of symptoms and signs of ED from patients were perceived by Bapedi healers as indicators of a successful treatment.

## Plant parts used

In the present study roots (58.3%), bulbs and tubers (12.5% each) were mostly preferred for medicinal preparations. In contrast the limited use of leaves (4.1%) by Bapedi healers for herbal preparation is contrary to that reported by Kamatenesi-Mugisha and Oryem-Origa (2005). These authors found that leaves were the most preferred part to treat ED, constituting 57.6% of herbal remedies in western Uganda. This exceptionally high usage relates to their availability throughout the year, as a function of the herbaceous habit of the species used.

In this study the widespread use of subterranean parts (roots, bulbs and tubers) to prepare medicine is based on the perception that more healing power is contained in them as opposed to other parts. This is in line with

**Table 3.** Diagnosis methods of ED mentioned by traditional healers.

Symptoms and signs	No of traditional healers*
Low sex drive	20
Weak erection	18
Lack of sexual desire	13

\*note that this is not a frequency table, as some traditional healers indicated more than one diagnostic criterion

scientific evidence that subterranean parts generally contain high concentrations of bioactive compounds than aerial parts (Moore, 1994). However, because their extensive harvesting is threatening the existence of the affected plant and ultimately the species (Poffenberger et al., 1992), healers should be encouraged to supplement this harvesting practice with parts such as leaves. It is reasonable to consider that the limited use of stem bark for herbal preparation by Bapedi healers is due to the large number of herbaceous species being employed to treat ED.

### Preparation and administration

Remedies were mostly prepared from a single plant (90.4%). In Kamatenesi-Mugisha and Oryem-Origa (2005) study, all remedies were made from a single plant species. Developing therapeutic activity-bearing compounds from a single species may be easier (Saikia et al., 2006) as opposed to those involving multi-species. However, in some instance (9.5%) Bapedi healers prepared a remedy using a combination of *S. longepedunculata* and *Z. humile*, or *H. obtusa* and *E. pallidiflora* subsp. *pole-evansii*. This was done to enhance the effectiveness of the remedy. Indeed Otieno et al. (2008) and Zonyane et al. (2012) demonstrated that multi-plant extracts are more superior over single plant extracts. It is therefore reasonable to speculate that the practice of Bapedi traditional healers to combine species might indeed enhance the effective of the remedies.

Medicines were prepared by boiling (61.9%) and pounding (38%). These are two of the most common methods of herbal preparations in South Africa (Van Wyk et al., 1997; De Wet et al., 2011) and other parts of Africa (Yirga, 2010; Tabuti et al., 2010). Depending on an individual healer, remedies were boiled from five to 20 minutes (Table 2). The preference of boiling might be due to its simplicity. However, limited use of pounding of medicinal material by Bapedi healers came as no surprise as it is a long and difficult process; the herbs must be cut into very small pieces, dried sufficiently to make them brittle, and then crushed intensively enough to reduce them to a reasonably fine powder.

Most (95.2%) herbal preparations were prescribed orally. Medication in a liquid dosage form is readily absorbed; hence its preference. Depending on a tradi-

tional healer, one to four metal tin cups (Approximately 300 ml) full of extracts was prescribed orally three times a day. In the case of pounded medicine three to six table spoons (again depending on a traditional healer) was prescribed to a patient, either with soft porridge or warm water three times a day. Both extracts and pounded prescriptions were taken for a period of two weeks or until disappearances of symptoms of ED as reported by the patient. It would seem that the time period of treatment do vary from culture to culture. For example, In the Oshikoto region of Namibia, home of the Ndonga tribe, herbal remedies for ED are prescribed for four days (Cheikhyoussef et al., 2011).

Rarely (4.7%) was a combination of *H. obtusa* (pounded tuber) and *E. pallidiflora* subsp. *pole-evansii* (pounded bulb) administered with warm water via a rectal bulb syringe; a traditional healer did the administration. According to Bapedi healers, rectal-administration is very dangerous and mostly administered by an experienced healer, as a wrong dosage might result in fatality.

### CONCLUSION

Medicinal plants used by Bapedi traditional healers can provide a treatment option that is affordable and available for South African men with ED. A significant number of species used by these healers are reported for the first time in treatment of ED. A majority of species have been validated more via their use by other cultures. Phytochemical and biological activity studies on the reported species are recommended as to understand their mode of actions.

### ACKNOWLEDGEMENTS

The authors are grateful to the traditional healers in the Capricorn, Sekhukhune and Waterberg districts of the Limpopo Province, South Africa for sharing their knowledge on herbal medicine.

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