



Ethnobotanical survey of plants used by Bapedi traditional healers to treat tuberculosis and its opportunistic infections in the Limpopo Province, South Africa

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ARTICLE INFO

Article history:

Received 15 March 2018

Received in revised form 13 May 2018

Accepted 2 October 2018

Available online 29 October 2018

Keywords:

Bapedi

Limpopo Province

Traditional healers

Tuberculosis

ABSTRACT

The present study explored the utilisation of medicinal plants by Bapedi traditional healers (THs) to treat and manage tuberculosis (TB) and its opportunistic infections in the three districts of Limpopo Province, South Africa. Data were gathered using a semi-structured questionnaire as a guide for conversation with 202 THs after obtaining informed consent. One hundred and eighty-four ($n = 184$) plant species distributed in 149 genera and 77 botanical families were used by these THs. Amongst the diverse botanical families noted, the Fabaceae (21 spp.), Asteraceae (12 spp.) and Malvaceae (11 spp.) were dominant. Remedies were predominantly prepared from roots (63.8%) and leaves (13.8%). Overall, a total of 275 recipes (71.2% = mono and 28.7% = poly), prepared chiefly via boiling (50.9%) and pounding (40.7%) were documented. The foremost methods of administering these formulae were orally (87.2%) and nasally (11.2%). The highest fidelity level value (100%) was recorded for *Capparis tomentosa*, *Cassipourea garcini*, *Catha edulis*, *Citrullus lanatus*, *Combretum hereroense*, *Datura stramonium*, *Dicoma anomala*, *Diospyros lycioides*, *Enicostema axillare*, *Gossypium herbaceum*, *Solanum catombelense*, *Stylochaeton natalensis*, *Zingiber officinale* and *Ziziphus zeyheriana* across the studied districts. *Cryptocarya transvaalensis*, *Lasiosiphon caffer* and *Warburgia salutaris* notched the highest integer according to use value index. In general, a large number of species used by Bapedi THs are, for the first time, documented as medicines for TB and its opportunistic infections. These new additions to the scientific literature emphasise the need to conduct more ethnobotanical studies focusing on TB.

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1. Introduction

Tuberculosis (TB) is an infectious disease caused by an organism called *Mycobacterium tuberculosis*. The common symptoms of TB include, amongst others, chronic persistent cough, fever, chest pain, fatigue and weight loss (Stanhope and Lancaster, 1996). Patients presenting with one or more of these symptoms are considered “TB suspect” and must be further investigated for active *Mycobacterium tuberculosis* infection (Department of Health, 2010).

According to the World Health Organisation (2004), TB is one of the leading causes of morbidity and mortality worldwide, infecting about nine million people and killing approximately two million annually, both in developed and developing countries. Approximately 7.892 cases of TB and an incidence of 12.3/100.000 were noted in 2013

amongst the inhabitants of the United Kingdom, London (Public Health England, 2014). In Asia, an estimated 5 million prevalence and 3.5 million incident cases of TB was reported in 2010 (World Health Organisation, 2012a). The incidence of TB cases has also been noticed in Africa as is the case for other developing countries. Tuberculosis episodes in Africa vary, however, according to the geographical regions. Uganda has a TB prevalence rate of 65%, with Tanzania at around 57% (Orodho et al., 2011). The incidence of this illness in the kingdom of Lesotho is also high, with an estimated 695 cases per 100.000 populations yearly (Satti et al., 2008). In Ghana, approximately 20,000 people were diagnosed with TB in 2011 (World Health Organisation, 2012b). An occurrence of 9.2% and 12% fatality rate of this infection were previously recorded in Nigeria (Salami and Oluboyo, 2003). Recent epidemiological literature concerted on TB indicates that the infection is also a huge public health problem across various provinces of South Africa. For instance, amongst the 20 leading single causes of premature mortality in the North West Province TB was ranked fourth, and sixth in the Mpumalanga Province, responsible for death in all genders (Bradshaw et al., 2000). The Free State Province has TB incidence rate

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of 857 per 100,000 people (Department of Health Free State Province, 2010). In Limpopo Province, TB was ranked fifth as the cause of death for all races (Igumbor et al., 2017).

Tuberculosis control programmes currently emphasise the Directly Observed Treatment Short Course (DOTS) strategy initiated by both the World Health Organization (WHO) and International Union against TB and lung diseases. In a nutshell, key tenets of the DOTS agenda are standardised treatment of 68 months for all infectious patients; with directly observed therapy for at least the initial two months (WHO, 2005). However, the treatment success especially in rural Africa is complicated by various factors including therapy delay by patients attributed to expensive travelling cost to treatment centres on daily basis, just to have a health worker watch them take their drugs (Russell, 2004). In addition to this, the emergence of multi-drugs resistant strains of *Mycobacterium tuberculosis* as well as its opportunistic infection with HIV/AIDS pose a serious challenge to TB treatment (Mann et al., 2009).

The rapid increase in TB infections amongst Africans coupled with lack of access to the modern healthcare services, cultural reasons and due to the aforesaid demerits of DOTS, most people rely on traditional healer's services for treatment of these infections. There is a growing amount of literature on the use of medicinal plants by THs to treat TB in various African countries such as Uganda (Tabuti et al., 2010), Nigeria (Ogbole and Ajaiyeoba 2010), Democratic Republic of the Congo (Ngbolua et al., 2014), Ghana (Nguta et al., 2015) and Tanzania (Orodho et al., 2011). In South Africa, to date there are only three ethnobotanical studies that have reported the herbal remedies and associated practices by THs to treat TB. Such studies were carried-out amongst the Xhosa (Lawal et al., 2014), Sotho (Phungula, 2015) and Pedi (Semanya and Maroyi, 2013) THs. It should be stated that the latter study was a pilot survey involving 52 Bapedi THs practicing in the Capricorn, Sekhukhune and Waterberg districts of the Limpopo Province, and it documented just 21 plant species belonging to 20 genera and 18 families. The aim of the current study was therefore to extensively and comprehensively investigate ethnobotanical practices of larger number of

Bapedi THs (excluding those questioned in 2013) pertinent to the treatment of TB and related symptoms in the same districts sampled by Semanya and Maroyi (2013).

2. Material and methods

2.1. Study area and population

The study was conducted in the 17 municipalities comprising Capricorn, Sekhukhune and Waterberg districts, of the Limpopo Province (Fig. 1). Five villages in each municipality were purposely selected for ethnobotanical investigations, because they are inhabited by Bapedi healers who treat tuberculosis and based on the fact that they are the cultural home of Bapedi. The Bapedi tribe who speak Sepedi language represents one of the largest cultures in respect of constituencies in the sampled villages. Overall, the studied areas are poorly developed and characterised by high level of poverty (Statistics South Africa, 2014), with most people rely on pensions and free government grants. There are no health services in most communities, and in villages where public healthcare facilities (e.i., clinics) exist, these are shared by people from many settlements.

2.2. Ethnobotanical survey and data collection

Before research activities were initiated, traditional leaders and THs from each selected village were visited and informed about our intention to conduct a survey. During this visit both parties were also enlightened about the aim of the study, and THs were requested to share their indigenous knowledge of plants used to treat TB and perceived opportunistic infections. Approval to conduct the survey was sought from the traditional leaders, and THs who agreed to participate in this study were requested to sign a consent form. All THs who participated during our 2013 study (Semanya and Maroyi, 2013), were excluded as participants in the current survey.

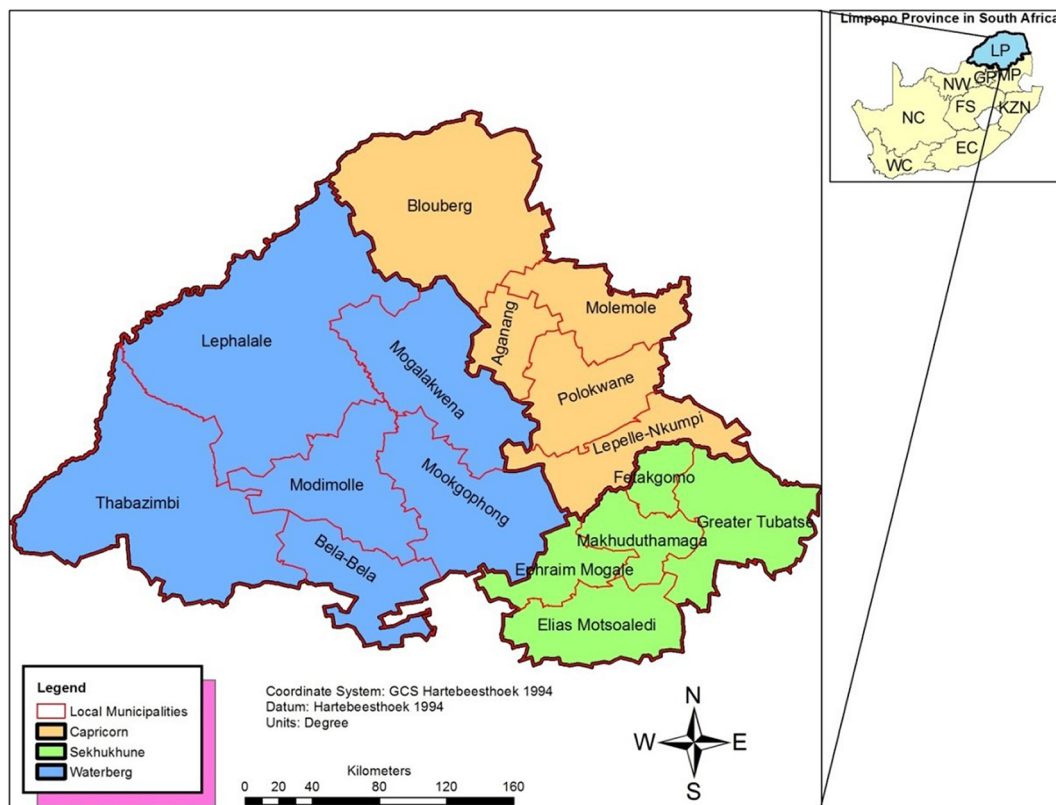


Fig. 1. Map of Limpopo Province indicating the studied areas (districts and municipalities).

Ethnobotanical information was conducted (from May 2017 to October 2017) using a semi-structured questionnaire during face-to-face interview with 202 conveniently sampled THs (i.e. selected on the basis of information provided by the local traditional leader and THs) who signed an informed consent form. This questionnaire was designed to ascertain information on the Pedi vernacular name/s of plants used medicinally to heal TB and opportunistic infections, used plant part/s, methods of herbal preparation, administration as well as dosage amongst other data. Overall, interviews were held separately with each healer in their own consultation room using the Sepedi language, to avoid outside influences.

After an interview session with THs, a field trip was conducted with each for plant identification, specimen collection and observation. All the species were initially identified by the THs by their vernacular name/s and subsequently researchers collected specimens. Plant specimens collected were prepared and deposited at the Larry Leach Herbarium (University of Limpopo) for taxonomic identification.

2.3. Data analysis

2.3.1. Micro soft excel and statistical package for the social sciences (SPSS)

Data from questionnaires were aggregated and processed for analysis using Micro Soft Excel 2000 and SPSS version 14.0. Descriptive statistics such as percentages and frequencies was used.

2.3.2. Fidelity level (FL)

The FL was calculated for each medicinal plant used by THs against TB and/or related symptoms by using the formula of Al-Quran (2009):

$$FL (\%) = \frac{Np}{N} \times 100.$$

Where Np was the number of THs who independently indicated the use of a particular plant species to treat TB or related symptoms, and N the total number of THs who mentioned the use of species as a medicine to treat any given ailment (TB/related symptom/s). Fidelity level index quantify the importance of a given species for a particular ailment in a given cultural group, and evaluate consensus amongst people regarding specific therapeutic effect/application of such species (Friedman et al., 1986). Therefore, in the context of this study, FL is an indicative value of how consistent the THs are and the extent to which they agree about the use of specific plant species for treatment of TB and/or related symptom/s.

2.3.3. Use value (UV)

The use value index is normally calculated for every ethnobotanically used plant species in order to evaluate a quantitative measure of its diversity of medicinal application and extent of utilisation by informants (Phillips and Gentry, 1993). Using the formula described below as proposed by these authors, we determined UV for individual plants implicated by Bapedi THs in the treatment of TB and related symptoms:

$$UV = \sum \frac{U}{N}$$

From the above formulation, U was the number of citations per species, where N represented the total number of THs. Plant with most versatile therapeutic applications or those that are highly accepted as a cure for a particular ailment will score a high UV.

3. Results and discussions

3.1. Diversity of used plant species

One hundred and eighty-four ($n = 184$) plant species (156 indigenous and 28 exotics) distributed in 149 genera and 77 botanical families

were reported by Bapedi THs as treatments of tuberculosis (TB) and related symptoms (Table 1). It is imperative to note that TB was considered by these THs as “full blown active TB”, and related symptoms were “certain TB signs in a person/patient considered TB suspect”. A comparison of our finding with previous, similar studies conducted amongst other cultures residing in South Africa shows that Bapedi THs utilise an extremely high diversity of plant species to treat TB and allied diseases. For instance, Lawal et al. (2014) who conducted a survey in the Nkonkobe Municipality, Eastern Cape Province (South Africa) found that Xhosa THs use 30 species as TB and related symptoms medicines (Lawal et al., 2014). In another survey but conducted in the Free State Province of South Africa, just 19 plants were listed as being used by Basotho THs to cure these ailments (Phungula, 2015). Similarly, further comparison of our results with those reported in related surveys carried out across South African borders also revealed that Bapedi THs use a greater diversity of medicinal plants. For example, THs in Congo (Ngbolua et al., 2014) and Ghana (Nguta et al., 2015) employ 26 and 15 plant species respectively, as therapies for TB and related symptoms. Mann et al. (2007) who questioned THs in Nigeria found that they used at least 95 plants as medicine for the investigated ailments. Traditional healers operating in the districts of Kamuli, Nakapiripirit and Kisoro, Uganda also use a substantial number ($n = 88$) of species to manage TB and related symptoms (Tabuti et al., 2010). Overall, the highest diversity of plant species used by Bapedi THs to cure these diseases as compared to those reported in all the above-stated studies may be the result of a number of factors. It might be due to the larger number of Bapedi THs questioned and comprehensively larger geographical areas covered, in comparison to these studies. Furthermore, other factors, such as local availability of medicinal plants and associated level of knowledge with respect to their application to counter TB and related diseases amongst Bapedi THs and participants in all the aforesaid studies might have also played a role.

Amongst the diverse botanical families noted in the present study, the Fabaceae (21 spp.), Asteraceae (12 spp.), Malvaceae (11 spp.), Celastraceae (7 spp.), Euphorbiaceae (6 spp.), Rutaceae and Solanaceae (5 spp., for each) were the best represented. Some of these families, notably Asteraceae (Tabuti et al., 2010; Lawal et al. 2014), Fabaceae (Ngbolua et al., 2014) and Solanaceae (Lawal et al., 2014) were previously reported as represented by higher numbers of taxa implicated by THs as medication for TB and opportunistic infections across various geographical areas of Africa. The dominance of these families in the current study and those executed by the aforesaid authors could be attributed to their wider distribution and abundance in the local flora, coupled with larger diversity of bioactive components, all of which contribute to representatives of these families becoming the first choice for treatment of these afflictions. The opposite of this supposition might be true for the remaining botanical families least represented (<4 spp.) in the present survey.

3.2. Plant habit

The floristic analysis of the species used by Bapedi THs to treat TB and related symptoms with regard to their habits revealed that trees (44.5%, $n = 82$), herbs (34.7%, $n = 64$) and shrubs (20.6%, $n = 38$), respectively are the most dominant life forms. This finding is in partial agreement with that of Ngbolua et al. (2014) who reported that THs practicing in Kinshasa City, Democratic Republic of the Congo mainly prefer trees and shrubs as medicine to heal these diseases. The supremacy of trees in the present study might be attributed to their availability throughout the year, or is just reflection of the foremost local habit that THs relies upon for the provision of medicines. On the other hand, the massive exploitation of herbaceous species in our study maybe due to the fact they grow in diverse conspicuous habitats (e.g. agricultural fields, disturbed areas and communal areas nearby THs homes) and thus can be easily accessed. Additionally, various morphological parts

Table 1
Medicinal plants used by traditional healers to treat tuberculosis and related symptoms in the Limpopo Province, South Africa.

Botanical family	Species name and voucher numbers	Vernacular name	Habit	Used plant parts	State of use	Methods of herbal preparation and administration	Aliment/s treated	Frequency of use; n = THs (202)		FL	UV
								UM	%		
Acanthaceae	<i>Blepharis diversispina</i> (Nees) C.B.Clarke SSS99	Setlwatlwa	Shrub	Root	Dry	Boiled for 3–5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	14	6.9	100	0.06
Acanthaceae	<i>Blepharis subvolubilis</i> C.B. Clarke SSS828	Mookapitsi	Shrub	Root	Dry	Boiled for 5–6 minutes. Extract is taken orally. Thrice a day	Chest pain	6	2.9	100	0.02
Agapanthaceae	<i>Agapanthus inapertus</i> P. Beav. SSS803	Lephofufofu	Shrub	Root	Dry	Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	2	0.9	100	0
Alliaceae	<i>Tulbaghia violacea</i> Harv. var. <i>violacea</i> SSS522	Moeye-ya-naga	Herb	Bulb	Fresh	Boiled for 4–7 minutes. Extract is taken orally. Thrice a day	Tuberculosis	6	2.9	100	0.02
Amaryllidaceae	* <i>Allium cepa</i> L. SSS06	Moeye	Herb	Bulb	Fresh	Boiled for 3–710 minutes. Steam is inhaled (nasally) under blanket. Thrice a day Or Boiled for 3–710 minutes. Extract taken orally. Thrice a day	Angina pain	1	0.4	50	0
<u>Amaryllidaceae</u>	* <i>Allium sativum</i> L. SSS78	Khonofolo	Herb	Bulb	Dry	Mixed with fresh bulb of <i>A. sativum</i> and leaf of <i>A. afra</i> . Boiled for 5 minutes. Steam is inhaled (nasally) under blanket. Thrice a day Pounded and taken orally with warm water. Thrice a day Mixed with fresh bulb of <i>A. cepa</i> and leaf of <i>A. afra</i> . Boiled for 5 minutes. Steam is inhaled (nasally) under blanket. Thrice a day	Tuberculosis Tuberculosis	6 1	3.4	100	0.03
Amaryllidaceae	<i>Clivia caulescens</i> R.A.Dyer SSS89	Maime	Herb	Root	Dry	Boiled for 4–10 minutes. Extract is taken orally. Thrice a day	Lack of appetite	4	1.9	100	0.01
Anacardiaceae	<i>Harpephyllum caffrum</i> Bernh. ex Krauss SSS604	Motšhidi-tshwene	Tree	Root	Dry	Boiled for 5 minutes. Extract is taken orally. Thrice a day	Headache	3	1.4	100	0.01
Anacardiaceae	<i>Ozoroa sphaerocarpa</i> R.Fern. & A. Fern. SSS07	Monoko	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Headache	5	2.4	100	0.02
Anacardiaceae	* <i>Schinus molle</i> L. SSS60	Thoba/Mokwepere	Tree	Leaf	Fresh	Boiled for 5–7 minutes. Steam is inhaled (nasally) under blanket. Thrice a day Mixed with fresh leaf of <i>R. communis</i> . Boiled for 5–10 minutes. Steam is inhaled (nasally) under blanket. Thrice a day	Tuberculosis Chronic cough Chronic cough	37 7 1	18.3 3.9	82.2 17.7	0.22
Anacardiaceae	<i>Sclerocarya birrea</i> (A.Rich.) Hochst. subsp. <i>caffra</i> (Sond.) SSS201	Morula/Mokano	Tree	Bark	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	1	0.4	100	0
Apiaceae	<i>Alepidea amatymbica</i> Eckl. & Zeyh. var. <i>amatymbica</i> SSS66	Lešokwane	Herb	Rhizome	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough Tuberculosis	202	100	50	2
Apiaceae	<i>Heteromopha arborescens</i> var. <i>frutescens</i> SSS04	Mohlologatšane	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	9	4.4	100	0.04
Apocynaceae	<i>Acokanthera rotundata</i> (Codd) Kupicha SSS203	Moethi	Shrub	Root	Dry	Boiled for 5–11 minutes. Extract is taken orally. Thrice a day	Headache	19	9.4	100	0.09
Apocynaceae	<i>Carissa bispinosa</i> (L.) Desf. ex Brenan SSS09	Leputlo/Mothokolo/Mošhukudu/Motholo	Tree	Root	Dry	Boiled for 5 minutes. Steam is inhaled (nasally) under blanket. Thrice a day Pounded and taken orally with warm water. Thrice a day Pounded and mixed with dried powdered root of <i>E. lysistemom</i> . Taken orally with warm water. Thrice a day	Angina pain Chest pain Tuberculosis Chronic cough	4 9 1 1	1.9 4.4 0.4 0.4	26.6 60 6.6 6.6	0.07
Apocynaceae	<i>Strophanthus speciosus</i> (Ward & Harv.) Reber SSS01	Morarwane	Shrub	Root	Dry	Boiled for 6–12 minutes. Extract is taken orally. Thrice a day	Chronic cough Tuberculosis	202 202	100 100	50 50	2

Araceae	<i>Stylochaeton natalensis</i> Schott SSS222	Mokunya/Mokušhete	Herb	Root	Dry	Boiled for 5 minutes. Extract is taken orally. Thrice a day Pounded and mixed with dried powdered root of <i>P. obliquum</i> . Boiled for 4 minutes. Steam is inhaled (nasally) under blanket. Thrice a day	Tuberculosis Tuberculosis	201 1	100 100	100 1	
Araceae	<i>Zantedeschia aethiopica</i> (L.) Spreng. SSS603	Mothebe	Herb	Root	Dry	Boiled for 5–6 minutes. Extract is taken orally. Thrice a day	Sore throat	1	0.4	100	0
Asparagaceae	<i>Asparagus buechananii</i> Baker SSS600	Mphalatsomaru/Morakadimane/Morakatshwene	Herb	Root	Dry	Boiled for 5–11 minutes. Extract is taken orally. Thrice a day	Chest pain	9	4.4	100	0.04
Asphodelaceae	<i>Aloe</i> spp. SSS16	Thogo/Marobadibogale	Shrub	Leaf	Fresh	Boiled for 6 minutes. Extract is taken orally. Thrice a day Mixed with fresh fruit of <i>C. lanatus</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day Mixed with dried root of <i>J. zeyheri</i> . Boiled for 3 minutes. Extract is taken orally. Thrice a day Macerated in warm for 5–2hrs. Decoction is taken orally. Thrice a day	Angina pain Headache Tuberculosis Tuberculosis	4 1 1 201	1.9 0.4	1.9 0.4	1.02
Asphodelaceae	<i>Aloe marlothii</i> A.Berger subsp. Marlothii SSS700	Sekgopha-sa-go-ema	Shrub	Leaf	Fresh	Mixed with dried powdered whole plant of <i>M. angustifolia</i> and bark of <i>W. salutaris</i> . Boiled for 5 minutes. Extract taken orally. Thrice a day	Chest pain Chronic cough	1 1	0.4 0.4	50 50	0
Asphodeloideae	<i>Aloe falcata</i> Baker SSS831	Sekgopha	Shrub	Leaf	Fresh	Macerated in warm water 2–5 hrs. Decoction is taken orally. Thrice a day	Chest pain	5	2.4	100	0.02
Asteraceae	<i>Artemisia afra</i> Jacq. ex Willd. var. <i>afra</i> SSS69	Legana/Moilanši	Herb	Leaf	Dry	Boiled for 4–5 minutes. Steam is inhaled (nasally) under blanket. Thrice a day Boiled for 3–7 minutes. Extract is taken orally. Thrice a day Mixed with fresh bulbs of <i>A. cepa</i> and <i>A. sativum</i> . Boiled for 5 minutes. Steam is inhaled (nasally) under blanket. Thrice a day Mixed with fresh leaf of <i>C. sativa</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day	Fever Chronic cough Tuberculosis Tuberculosis	202 202 197 1	100 100 100	33.3 33.3 33.3	3
Asteraceae	<i>Athrixia phyllicoides</i> DC SSS714	Mohlalhaiša/Mmangwako	Shrub	Leaf	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough	5	2.4	100	0.02
Asteraceae	<i>Brachylaena transvaalensis</i> E. Phillips & Schweick SSS51	Mokau/Molalale	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough Tuberculosis	5 1	2.4 0.4	83.3 16.6	0.02
Asteraceae	<i>Callilepis laureola</i> DC. SSS11	Phela/Hlonya/Makuru/Pedipekanto	Herb	Root	Dry	Boiled and extract is taken orally. Thrice a day Mixed with dried roots of <i>C. menyharthii</i> and <i>S. italica</i> , and fresh bulbs of <i>D. elata</i> and <i>S. aethiopicus</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day Mixed with fresh leaf of <i>C. edulis</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day Pounded and mixed with dried powered root of <i>Z. capense</i> . Taken orally with warm water. Thrice a day Mixed with dried powered root of <i>Z. capense</i> , bark of <i>W. salutaris</i> , and fresh bulb of <i>S. aethiopicus</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day Boiled for 7–9 minutes. Extract is taken orally. Thrice a day	Chronic cough Tuberculosis Tuberculosis Tuberculosis Tuberculosis	202 1 1 1 198	100 100	50 50	2
Asteraceae	<i>Dicoma anomala</i> subsp. Gerrardii SSS525	Phelana/Makušwaneng	Herb	Root	Dry	Boiled for 5–8 minutes. Extract is taken orally. Thrice a day Or Pounded and taken orally with warm water. Thrice a day Mixed with fresh bulbs of <i>D. elata</i> and <i>E. autumnalis</i> . Boiled for 6 minutes. Extract is taken orally. Thrice a day	Tuberculosis Tuberculosis	201 1	100 100	100 1	1
Asteraceae	<i>Helichrysum kraussii</i> Sch.Bip. SSS513	Lengalane	Shrub	Whole plant	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	1	0.4	100	0
Asteraceae	<i>Helichrysum gymnocomum</i> DC. SSS18	Mpepho	Herb	Whole plant	Dry	Mixed with dried bark of <i>W. salutaris</i> . Boiled for 8 minutes. Steam is inhaled (nasally) under blanket. Thrice	Chest pain	1	0.4	100	0

(continued on next page)

						Fresh	Mixed with dried leaf of <i>A. afra</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	25	14.8	60	
							Extract is taken orally. Thrice a day	Tuberculosis	4			
							Mixed with fresh tuber of <i>S. aethiopicus</i> . Macerated in warm water for 24 hrs. Decoction is taken orally. Thrice a day	Tuberculosis	1			
Capparaceae	<i>Boscia albitrunca</i> (Burch.) Gilg & Gilg-Ben. SSS701	Mohlopi	Tree	Root	Dry	Burned for about 3–8 seconds. Smoke is inhaled (nasally). Thrice a day	Headache	7	3.4	100	0.03	
Capparaceae	<i>Capparis tomentosa</i> Lam. SSS30	Moopatladi	Tree	Root	Dry	Burned for 5–10 seconds. Smoke is inhaled (nasally). Thrice a day	Headache	202	100	100	1	
Caricaceae	* <i>Carica papaya</i> L. SSS510	Mophopho	Tree	Root	Dry	Pounded and mixed with dried powdered root of <i>P. zeylanica</i> and mixed with Vicks® and used topically to rub the painful chest	Chest pain	1	0.4	100	0	
Celastraceae	<i>Catha edulis</i> (Vahl) Forssk. ex Endl. SSS74	Lehlatse/Lewang/Molomomonate	Tree	Root	Dry	Pounded and is taken orally with warm water. Thrice a day	Lack of appetite	202	100	100	1	
Celastraceae	<i>Elaeodendron transvaalense</i> (Burt Davy) R.H.Archer SSS80	Monamane	Tree	Root	Dry	Mixed with fresh bulb of <i>D. elata</i> . Boiled for 6 minutes. Extract is taken orally. Thrice a day	Chest pain	1	0.4	100	0	
Celastraceae	<i>Gymnosporia maranguensis</i> (Loes.) Loes. SSS801	Mokgoropo	Tree	Root	Dry	Pounded and taken orally with soft porridge. Thrice a day	Tuberculosis	12	5.9	100	0.05	
Celastraceae	<i>Gymnosporia pubescens</i> (N. Robson) Jordaan SSS79	Mohlakaome	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Sore throat	3	1.4	100	0.01	
Celastraceae	<i>Gymnosporia senegalensis</i> (Lam.) Loes. SSS821	Mphato	Tree	Root	Dry	Boiled for 5–9 minutes. Extract is taken orally. Thrice a day	Tuberculosis	2	0.9	100	0	
Celastraceae	<i>Pleurostylia capensis</i> (Turcz.) Loes SSS806	Sekgagga	Tree	Root	Fresh	Boiled for 5 minutes. Steam is inhaled (nasally) under blanket. Thrice a day	Tuberculosis	1	0.4	100	0	
Celastraceae	<i>Pristimera longipetiolata</i> (Oliv.) N.Hall SSS507	Mohufe	Shrub	Root	Dry	Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	3	1.4	100	0.01	
Clusiaceae	<i>Garcinia gerrardii</i> Harv. ex Sim SSS832	-	Shrub	Root	Dry	Boiled for 3 minutes. Extract is taken orally. Thrice a day	Chronic cough	2	0.9	66.6	0.01	
Combretaceae	<i>Combretum hereroense</i> Schinz subsp. Hereroense SSS98	Modulakgogo	Tree	Root	Dry	Boiled for 6 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1	0.4	33.3		
Combretaceae	<i>Combretum zeyheri</i> Sond SSS506	Moduba	Tree	Root	Dry	Boiled for 5–9 minutes. Extract is taken orally. Thrice a day	Tuberculosis	202	100	100	1	
Combretaceae	<i>Terminalia sericea</i> Burch. ex DC. SSS514	Monekanekane/Mogonono	Tree	Root or leaf	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough	1	0.4	50	0.01	
Commelinaceae	<i>Commelina subulata</i> Roth SSS72	Bolebatša	Herb	Root	Dry	Boiled for 6 minutes. Extract is taken orally. Thrice a day	Headache	10	83.3	100	0.04	
Convolvulaceae	<i>Ipomoea albivenia</i> (Lindl.) Sweet SSS92	Mošope	Shrub	Root	Dry	Boiled for 4–5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1	0.4	50		
Cucurbitaceae	<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai SSS813	Mogapu	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	5	2.4	100	0.02	
Cucurbitaceae	<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai SSS813	Mogapu	Herb	Fruit	Fresh	Mixed with fresh leaf of <i>Aloe spp.</i> Boiled for 5 minutes. Extract is taken orally. Thrice a day	Headache	201	100	100	1	
Cucurbitaceae	<i>Cucumis metuliferus</i> E.Mey. ex Naudin SSS713	Tšhitšhi	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Headache	1				
Cucurbitaceae	<i>Cucumis zeyheri</i> Sond. SSS823	Mokiti	Herb	Fruit	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	15	7.4	100	0.07	
Cucurbitaceae	<i>Cucumis zeyheri</i> Sond. SSS823	Mokiti	Herb	Fruit	Dry	Pounded and mixed with dried powdered bark of <i>S. petersiana</i> . Taken orally with warm water	Tuberculosis	15	7.9	100	0.07	
Cucurbitaceae	<i>Momordica balsamina</i> L. SSS300	Mosegasegane/Nkaka/Molobolo	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	1				
Cyperaceae	<i>Cyperus sexangularis</i> Nees SSS602	Mohlaha	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough	5	2.4	100	0.02	
Dioscoreaceae	<i>Cyperus sexangularis</i> Nees SSS602	Mohlaha	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	30	14.8	100	0.14	
Dioscoreaceae	<i>Dioscorea dregeana</i> (Kunth) T. Durand & Schinz SSS83	Mabele-apoo	Herb	Tuber	Dry	Macerated in warm water for 24hrs. Decoction is taken orally. Thrice a day	Tuberculosis	1	0.4	100	0	
Dioscoreaceae	<i>Dioscorea sylvatica</i> Eckl. var. <i>brevipes</i> (Burt Davy) Burkill SSS91	Kgato	Herb	Tuber	Dry	Boiled for 6 minutes. Extract is taken orally. Thrice a day	Tuberculosis	64	31.6	100	0.31	

(continued on next page)

Table 1 (continued)

Botanical family	Species name and voucher numbers	Vernacular name	Habit	Used plant parts	State of use	Methods of herbal preparation and administration	Aliment/s treated	Frequency of use; n = THs (202)		FL	UV
								UM	%		
Dracaenaceae	<i>Sansevieria hyacinthoides</i> (L.) Druce SSS508	Mokgotse	Herb	Root	Fresh	Boiled for 4–8 minutes. Extract is taken orally. Thrice a day	Chronic cough	3	1.4	100	0.01
Ebenaceae	<i>Diospyros lycioides</i> Desf. subsp. <i>sericea</i> (Bernh.) De Winter SSS819	Monna-moso/Mohlakolaswiswi	Tree	Root	Dry	Boiled for 5–13 minutes. Extract is taken orally. Thrice a day Or Boiled for 4 minutes. Steam is inhaled (nasally) under blanket. Thrice a day	Headache	202	100	100	1
Ebenaceae	<i>Diospyros mespiliformis</i> Hochst. ex A.DC SSS36	Motlouma	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	9	4.4	100	0.04
Ebenaceae	<i>Euclea undulata</i> Thunb. SSS200	Mohlakola	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	2	0.9	100	0
Euphorbiaceae	<i>Euphorbia inaequilatera</i> Sond. var. <i>inaequilatera</i> SSS13	Kgamaswana/Mmatelaface	Herb	Whole plant	Dry	Burned for about 4–15 seconds. Smoke is inhaled (nasally). Thrice a day	Chest pain	2	0.9	100	0
Euphorbiaceae	<i>Croton gratissimus</i> Burch. var. <i>gratissimus</i> SSS28	Moolologa/Selogane	Tree	Root	Dry	Boiled for 6–10 minutes. Extract is taken orally. Thrice a day Or Pounded and taken orally with warm water. Thrice a day Pounded and mixed with fresh tuber of <i>S. aethiopicus</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day	Sore throat Tuberculosis Tuberculosis	202 12 1	100 6.4 6	93.9 6	1.06
Euphorbiaceae	<i>Croton menyharthii</i> Pax SSS309	Moologa	Tree	Root	Dry	Boiled for 5 minutes. Extract is taken orally. Thrice a day Mixed with dried roots of <i>C. laureola</i> and <i>S. italica</i> , and fresh bulbs of <i>D. elata</i> and <i>S. aethiopicus</i> . Boiled for 5 minutes. Extract taken orally. Thrice a day Boiled for 5–6 minutes. Extract is taken orally. Thrice a day	Chronic cough Tuberculosis	7 1	3.4 0.9	77.7 22.2	0.04
Euphorbiaceae	<i>Jatropha zeyheri</i> Sond. SSS333	Sephapabadiya	Herb	Root	Dry	Boiled for 3 minutes. Extract is taken orally. Thrice a day Mixed with fresh leaf of <i>Aloe spp.</i> Boiled for 3 minutes. Extract is taken orally. Thrice a day Mixed with fresh bulb of <i>D. sanguinea</i> and tuber of <i>H. hemerocallidea</i> . Boiled for 7 minutes. Extract is taken orally. Thrice a day	Tuberculosis Tuberculosis Tuberculosis	2 1 1	1.9	100	0.01
Euphorbiaceae	* <i>Ricinus communis</i> L. var. <i>communis</i> SSS33	Mokhure	Shrub	Leaf	Fresh	Boiled for 5–8 minutes. Warm extract is used topically to wash body. Thrice a day Mixed with fresh leaf of <i>S. molle</i> . Boiled for 5–10 minutes. Steam is inhaled (nasally) under blanket. Thrice a day Mixed with fresh bulb of <i>D. elata</i> . Boiled for 6 minutes. Steam is inhaled (nasally) under blanket. Thrice a day	Chronic cough Chronic cough Tuberculosis	1 1 1	0.9	75 25	0.01
Euphorbiaceae	<i>Tragia dioica</i> Sond. SSS14	Bogopa/Mabatšane	Herb	Leaf	Dry	Pounded and taken orally with warm water. Thrice a day.	Tuberculosis	6	2.9	100	0.02
Fabaceae	<i>Acacia erioloba</i> E.Mey. SSS22	Mogohlo/Mošu	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day.	Tuberculosis	9	4.4	100	0.04
Fabaceae	<i>Acacia senegal</i> (L.) Willd. var. <i>rostrata</i> Brenan SSS34	Mokgaripe	Tree	Root	Dry	Boiled for 6–11 minutes. Extract is taken orally. Thrice a day	Chronic cough Chest pain Tuberculosis	202 202 202	100 100 100	33.3 33.3	3
Fabaceae	<i>Albizia adianthifolia</i> (Schumach.) W.Wight var. <i>adianthifolia</i> SSS40	Mafahla-nare	Tree	Root	Dry	Boiled for 5–12 minutes. Extract is taken orally. Thrice a day Or Pounded and taken orally with warm water. Thrice a day	Tuberculosis	4	1.9	100	0.01
Fabaceae	<i>Albizia anthelmintica</i> (A.Rich.) Brongn SSS39	Mohlaphuhla	Tree	Root	Dry	Burned for about 4–6 seconds. Smoke is inhaled (nasally). Thrice a day	Headache	13	6.4	100	0.06
Fabaceae	<i>Burkea africana</i> Hook. SSS814	Monatlo	Tree	Root	Dry	Boiled for 4 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1	0.4	100	0
Fabaceae	<i>Cassia abbreviata</i> Oliv. subsp.	Monepenepene	Tree	Bark	Dry	Boiled for 5–9 minutes. Extract is taken orally. Thrice a day	Chest pain	10	4.9	100	0.04

	beareana (Holmes) Brenan SSS57					day								
Fabaceae	<i>Dichrostachys cinerea</i> (L.) Wight & Arn. subsp. africana Brenan & Brummitt var. Africana SSS61	Moselesele/ Moretšhe	Tree	Root	Dry	Boiled for 7–10 minutes. Extract is taken orally. Thrice a day	Tuberculosis	197	97.5	100	0.97			
Fabaceae	<i>Elephantorrhiza burkei</i> Benth. SSS70	Mošišane/Batswetsi	Shrub	Root	Dry	Boiled for 5–8 minutes. Extract is taken orally. Thrice a day	Tuberculosis	6	2.9	100	0.02			
Fabaceae	<i>Elephantorrhiza goetzei</i> (Harms) Harms subsp. Goetzei SSS810	Mošitšane	Shrub	Root	Dry	Boiled for 3–6 minutes. Extract is taken orally. Thrice a day	Chronic cough	6	2.9	100	0.02			
Fabaceae	<i>Erythrina lysistemon</i> Hutch. SSS312	Sebalo/Mmale	Tree	Bark	Dry	Boiled for 5–8 minutes. Extract is taken orally. Thrice a day Pounded and mixed with dried powdered root of <i>C. bispinosa</i> . Taken orally with warm water. Thrice a day	Chronic cough Chronic cough Tuberculosis	3 1 1	1.9	80	0.02			
Fabaceae	<i>Mundulea sericea</i> (Willd.) A. Chev. subsp. sericea SSS503	Mošitatlou	Tree	Root	Dry	Pounded and mixed with dried powdered root of <i>O. lanceolata</i> . Taken orally with warm water. Pounded and taken orally with warm water. Thrice a day	Tuberculosis	1	1.9	100	0.01			
Fabaceae	<i>Peltophorum africanum</i> Sond. SSS47	Mosehla	Tree	Bark	Dry	Boiled for 5–11 minutes. Extracts taken orally. Thrice a day	Chronic cough	18	8.9	100	0.08			
Fabaceae	<i>Philenoptera violacea</i> (Klotzsch) Schrire SSS44	Mphata	Tree	Bark	Dry	Boiled 5–10 minutes. Extract is taken orally. Thrice a day	Chronic cough	13	6.4	100	0.06			
Fabaceae	<i>Rhynchosia hirta</i> (Andrews) Meikle & Verdc. SSS45	Terebe-ya-nageng	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	19	9.4	100	0.09			
Fabaceae	<i>Schotia brachypetala</i> Sond. SSS520	Molope	Tree	Root	Dry	Boiled and extract is taken orally. Thrice a day	Tuberculosis	4	1.9	100	0.01			
Fabaceae	* <i>Senna didymobotrya</i> (Fresen.) H.S.Irwin & Barneby SSS50	Moroteladitšhoši-o-mogolo	Shrub	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough	8	3.9	100	0.03			
Fabaceae	<i>Senna italica</i> Mill. subsp. arachoides (Burch.) Lock SSS515	Moroteladitšhoši	Herb	Root	Dry	Boiled for 4–8 minutes. Extract is taken orally. Thrice a day Mixed with dried roots of <i>C. laureola</i> , <i>C. menyharthii</i> and fresh bulbs of <i>D. elata</i> and <i>S. aethiopicus</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day Pounded and taken orally with warm water. Thrice a day	Chronic cough Tuberculosis	4 1	1.9	66.6	0.02			
Fabaceae	<i>Senna occidentalis</i> (L.) Link. SSS302	Moroteladitšhoši-omogolo	Tree	Root	Dry	Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1 2	0.9	100	0.09			
Fabaceae	<i>Senna petersiana</i> (Bolle) Lock SSS511	Monepenene	Tree	Root	Dry	Pounded and mixed with dried powdered root of <i>S. panduriforme</i> . Taken orally with warm water. Thrice a day Pounded and mixed with dried powdered fruit of <i>C. zeyheri</i> . Taken orally with warm water. Thrice a day	Lack of appetite Tuberculosis	1 1	0.4	50	0			
Fabaceae	<i>Tylosema fassoglense</i> (Schweinf.) Torre & Hillc. SSS410	Monoga	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	12	5.9	100	0.05			
Fabaceae	<i>Vigna frutescens</i> A.Rich. subsp. frutescens var. frutescens SSS49	Moraranwe	Herb	Root	Dry	Boiled for 5–9 minutes. Extract is taken orally. Thrice a day	Chronic cough	3	1.4	100	0.01			
Gentianaceae	<i>Enicostema axillare</i> (Lam.) A. Raynal subsp. Axillare SSS517	Makgonotšohle/Mphedu-ya-thaba	Herb	Whole plant	Dry	Boiled for 5–14 minutes. Extract is taken orally. Thrice a day Or Pounded and taken orally with warm water. Thrice a day Pounded and mixed with dried powdered root of <i>C. woodii</i> . Taken orally with warm water. Thrice a day	Tuberculosis	201 1	100	100	1			
Geraniaceae	<i>Monsonia angustifolia</i> E.Mey. ex A.Rich. SSS48	Teye-ya-thaba	Herb	Whole plant	Dry	Pounded and mixed with fresh leaf of <i>A. marlothii</i> and dried powdered bark of <i>W. salutaris</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day Boiled for 5–8 minutes. Extract is taken orally. Thrice a day	Chest pain Chronic cough Chronic cough	1 1 12	0.4 6.4	6.6 86.6	0.07			

(continued on next page)

Table 1 (continued)

Botanical family	Species name and voucher numbers	Vernacular name	Habit	Used plant parts	State of use	Methods of herbal preparation and administration	Aliment/s treated	Frequency of use; n = THs (202)		FL	UV
								UM	%		
Hyacinthaceae	<i>Drimia elata</i> Jacq. SSS521	Sekanama	Herb	Bulb	Fresh	Boiled for 6 minutes. Extract is taken orally. Thrice a day Mixed with dried roots of <i>C. laureola</i> , <i>C. menyharthii</i> and <i>S. italica</i> , and fresh bulb of <i>S. aethiopicus</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day Boiled for 5–9 minutes. Extract is taken orally. Thrice a day Mixed with dried bark of <i>W. salutaris</i> . Boiled for 3 minutes. Extract is taken orally. Thrice a day Mixed with fresh leaf of <i>R. communis</i> . Boiled for 6 minutes. Steam is inhaled (nasally) under blanket. Thrice a day Mixed with dried root of <i>D. anomala</i> and fresh bulb of <i>E. autumnalis</i> . Boiled for 6 minutes. Extract is taken orally. Thrice a day Mixed with dried root of <i>E. transvaalense</i> . Boiled for 6 minutes. Extract is taken orally. Thrice a day Boiled for 5–12 minutes. Extract is taken orally. Thrice a day	Fever	1	0.4	6.6	0.14
							Angina pain	4	1.9	13.3	
							Tuberculosis	1	7.9	53.3	
							Tuberculosis	12			
							Tuberculosis	1			
							Tuberculosis	1			
							Tuberculosis	1			
Hyacinthaceae	<i>Drimia sanguinea</i> (Schinz) Jessop SSS90	Sekanama	Herb	Bulb	Fresh	Mixed with dried bark of <i>W. salutaris</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day Mixed with fresh tuber of <i>H. hemerocallidea</i> and dried root of <i>J. zeyheri</i> . Boiled for 7 minutes and extract is taken orally. Thrice a day	Chest pain	1	0.4	50	0
							Tuberculosis	1	0.4	50	
Hyacinthaceae	<i>Eucomis autumnalis</i> (Mill.) Chitt. SSS820	Mathubadifala	Herb	Bulb	Fresh	Mixed with dried root of <i>D. anomala</i> and fresh bulb of <i>D. elata</i> . Boiled for 6 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1	0.4	100	0
Hyacinthaceae	<i>Eucomis pallidiflora</i> Baker subsp. <i>pole-evansii</i> (N.E.Br.) Reyneke ex J.C.Manning SSS817	Mathubadifala	Herb	Bulb	Fresh	Boiled for 5–8 minutes. Steam is inhaled (nasally) under blanket. Thrice a day Boiled for 5–10 minutes. Extract is taken orally. Thrice a day	Angina pain	4	1.9	1.9	1.01
							Chest pain	202	100	98	
Hypoxidaceae	<i>Hypoxis hemerocallidea</i> Fisch., C.A.Mey. & Avé-Lall SSS717	Hlakudiboya/Titikwane/Sekgekolwana	Herb	Tuber	Fresh	Boiled for 5–12 minutes. Extract is taken orally. Thrice a day Mixed with fresh bulb of <i>D. sanguinea</i> and dried root of <i>J. zeyheri</i> . Boiled for 7 minutes. Extract is taken orally. Thrice a day	Tuberculosis	13	6.9	100	0.06
							Tuberculosis	1			
Hypoxidaceae	<i>Hypoxis obtusa</i> Burch. ex Ker Gawl. SSS63	Monna maledu	Herb	Tuber	Fresh	Boiled for 4–7 minutes. Extract is taken orally. Thrice a day	Lack of appetite	1	0.4	100	0
Icacinaeae	<i>Cassinopsis ilicifolia</i> (Hochst.) Kuntze SSS711	Mohufi/Mohufe	Tree	Root	Dry	Boiled for 5–7 minutes. Extract is taken orally. Thrice a day	Tuberculosis	10	4.9	100	0.04
Icacinaeae	<i>Pyrenacantha grandiflora</i> Baill. SSS703	Bjere	Shrub	Root	Dry	Boiled for 5–9 minutes. Extract is taken orally. Thrice a day	Tuberculosis	9	4.4	100	0.04
Kirkiaceae	<i>Kirkia wilmsii</i> Engl. SSS706	Modumela/mogaba	Tree	Bark	Fresh	Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	7	3.4	100	0.03
Lamiaceae	<i>Clerodendrum glabrum</i> E.Mey. var. <i>angustifolium</i> E.Mey. SSS712	Mohlokholoko	Tree	Leaf	Fresh	Boiled for 5–8 minutes. Extract is taken orally. Thrice a day	Angina pain	1	0.4	5.2	0.09
							Chronic cough	3	1.4	15.7	
Lamiaceae	<i>Clerodendrum ternatum</i> Schinz SSS825	Sebokane	Herb	Whole plant	Dry	Boiled for 5–7 minutes. Extract is taken orally. Thrice a day Or Pounded and taken orally with warm water. Thrice a day	Tuberculosis	15	7.4	78.9	
							Chronic cough	202	100	50	2
Lamiaceae	<i>Leonotis leonurus</i> (L.) R.Br.	Lebake	Shrub	Root or	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	202	100	50	
							Chronic	5	2.4	100	0.02

Table 1 (continued)

Botanical family	Species name and voucher numbers	Vernacular name	Habit	Used plant parts	State of use	Methods of herbal preparation and administration	Aliment/s treated	Frequency of use; n = THs (202)		FL	UV
								UM	%		
Oleaceae	<i>Olea europaea</i> L. subsp. <i>africana</i> (Mill.) P.S.Green SSS708	Mohlware/Mo-olive	Tree	Root	Dry	Boiled for 5–12 minutes. Extract is taken orally. Thrice a day	Tuberculosis	10	4.9	100	0.04
Punicaceae	* <i>Panica granatum</i> L. SSS77	Mokgarenate	Tree	Fruit scale	Fresh	Mixed with fresh leaves of <i>C. sinensis</i> and <i>P. guajava</i> . Boiled for 7 minutes. Extract is taken orally. Thrice a day Chew as raw (orally). Thrice a day	Lack of appetite Lack of appetite	1 1	0.9	100	0
Papaveraceae	* <i>Argemone ochroleuca</i> Sweet subsp. <i>Ochroleuca</i> SSS528	Unknown	Herb	Root	Dry	Boiled for 7 minutes. Extract is taken orally. Thrice a day	Tuberculosis	4	1.9	100	0.01
Passifloraceae	<i>Adenia fruticosa</i> Burtt Davy subsp. <i>fruticosa</i> SSS502	Mopowane	Shrub	Root	Dry	Boiled for 5–13 minutes. Extract is taken orally. Thrice a day	Tuberculosis	8	3.9	100	0.03
Passifloraceae	<i>Adenia spinosa</i> Burtt Davy SSS12	Monna-apare/Pisayabatšumi/Mothema	Shrub	Stem	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough Tuberculosis	85 69	42 34.1	55.1 44.8	0.76
Pedaliaceae	<i>Dicerocaryum senecioides</i> (Klotzsch) Abels SSS705	Momphati	Herb	Leaf	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough Tuberculosis	12 8	5.9 3.9	60 40	0.09
Plumbaginaceae	<i>Plumbago zeylanica</i> L. SSS03	Mašimabe/Mašegomabe	Shrub	Root	Dry	Boiled for 6–13 minutes. Extract is taken orally. Thrice a day Pounded and mixed with dried powdered root of <i>C. papaya</i> and mixed with Vicks® and used topically to rub the painful chest	Chronic cough Sore throat Tuberculosis Chest pain Chest pain	202 202 8 1	100 100 4.4	32.8 32.8 1.4	3.04
Poaceae	* <i>Pennisetum glaucum</i> (L.) R.Br SSS46	Unknown	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	2	0.9	100	0
Poaceae	* <i>Saccharum officinarum</i> L. SSS310	Mmoba	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	2	0.9	100	0
Poaceae	<i>Sorghum bicolor</i> (L.) Moench subsp. <i>arundinaceum</i> (Desv.) de Wet & Harlan SSS304	Mabele-thoro	Herb	Seed	Dry	Pounded and taken orally with warm water. thrice a day	Tuberculosis	3	1.4	100	0.01
Poaceae	* <i>Zea mays</i> subsp. <i>mays</i> L. SSS38	Mabele	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough	1	0.4	100	0
Polygalaceae	<i>Securidaca longepedunculata</i> Fresen. var. <i>longepedunculata</i> SSS409	Mphesu/Mpitlamarago	Tree	Root	Dry	Boiled for 5–10 minutes. Steam is inhaled (nasally) under blanket. Thrice a day Pounded and mixed with dried powdered root of <i>Z. capense</i> . Taken orally with warm water. Thrice a day	Headache Tuberculosis	202 1	100 0.4	99.5 0.4	1.04
Portulacaceae	<i>Portulacaria afra</i> Jag. SSS37	Sehlaré-sa mafahla	Tree	Leaf	Fresh	Chewed (orally) as raw and sap is swallowed. Thrice a day	Tuberculosis	10	4.9	100	0.04
Portulacaceae	* <i>Portulaca oleracea</i> L. SSS10	Unknown	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	2	0.9	100	0
Proteaceae	<i>Protea caffra</i> Meisn. subsp. <i>caffra</i> SSS35	Modumela	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	34	16.8	100	0.16
Ptaeroxylaceae	<i>Ptaeroxylon obliquum</i> (Thunb.) Radlk. SSS32	Mogabaletswana	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day Pounded and mixed with dried powered root of <i>S. natalensis</i> . Boiled for 4 minutes. Steam is inhaled (nasally) under blanket. Thrice a day	Tuberculosis Tuberculosis	28 1	14.3	100	0.14
Pteridaceae	<i>Adiantum capillus-veneris</i> L. SSS29	Mmalewaneng	Herb	Whole plant	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough Tuberculosis	3 11	1.4 5.4	21.4 78.5	0.06
Ranunculaceae	<i>Clematis brachiata</i> Thunb. SSS809	Motlema-poo/Makgwatiane	Herb	Root	Dry	Burned for about 5–6 minutes. Smoke is inhaled (nasally). Thrice a day	Headache	5	2.4	100	0.02

Rhamnaceae	<i>Ziziphus mucronata</i> Willd. subsp. <i>mucronata</i> SSS827	Mokgalo	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	5	2.4	100	0.02
Rhamnaceae	<i>Ziziphus zeyheriana</i> Sond. SSS02	mokgalwana/sekgalwana	Shrub	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	202	100	100	1
Rhizophoraceae	<i>Cassipourea garcini</i> (Shinz) Alstroron SSS834	Molomomonate	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Lack of appetite	202	100	100	1
Rosaceae	* <i>Eriobotrya japonica</i> (Thunb.) Lindl. SSS800	Unknown	Tree	Leaf	Fresh	Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	4	1.9	100	0.01
Rosaceae	* <i>Prunus persica</i> (L.) Batsch var. <i>persica</i> SSS900	Moperekisi	Tree	Seed	Dry	Burned for about 5 seconds in a confined area. Smoke is inhaled (nasally). Thrice a day	Headache	1	0.4	100	0
Rutaceae	* <i>Citrus limon</i> (L.) Burm.f. SSS808	Moswiri	Tree	Seed	Dry	Burned in a confined area. Smoke is inhaled (nasally). Thrice a day	Angina pain	1	0.4	100	0
Rutaceae	* <i>Citrus sinensis</i> (L.) Osbeck SSS835	Monamune	Tree	Leaf	Fresh	Mixed with fresh leaves of <i>P. granatum</i> and <i>P. guajava</i> . Boiled for 7 minutes. Extract is taken orally. Thrice a day	Lack of appetite	1	0.4	100	0
Rutaceae	<i>Vepris reflexa</i> I. Verd. SSS27	Pharagobe	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Headache	1	0.4	100	0
Rutaceae	<i>Zanthoxylum capense</i> (Thunb.) Harv. SSS31	Monokwane/ Moregakgaka	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough	202	100	33	3.02
						Pounded and mixed with dried powdered roots of <i>C. laureola</i> and <i>W. salutaris</i> . Taken orally with warm water. Thrice a day	Sore throat	200	100	33	
						Pounded and mixed with dried powdered bark of <i>W. salutaris</i> . Taken orally with warm water. Thrice a day	Sore throat	1			
						Pounded and mixed with dried powdered bark of <i>W. salutaris</i> . Taken orally with warm water. Thrice a day	Chest pain	5	2.4	0.8	
						Pounded and mixed with dried powdered root of <i>C. laureola</i> . Taken orally with warm water. Thrice a day	Tuberculosis	1	100	33	
						Pounded and mixed with dried powdered root of <i>C. laureola</i> and dried bark of <i>W. salutaris</i> , and fresh bulb of <i>S. aethiopicus</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1			
						Pounded and mixed with dried powdered root of <i>S. longepedunculata</i> . Taken orally with warm water. Thrice a day	Tuberculosis	1			
						Pounded and mixed with fresh bulb of <i>S. aethiopicus</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1			
						Pounded and mixed with powdered root of <i>W. salutaris</i> . Taken orally with warm water. Thrice a day	Tuberculosis	3			
						Pounded and taken orally with warm water. Thrice a day	Tuberculosis	195			
Rutaceae	<i>Zanthoxylum humile</i> (E.A. Bruce) P.G. Waterman SSS900	Senokomaropa	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	1	0.4	100	0
Salicaceae	<i>Salix mucronata</i> Thunb. SSS303	Unknown	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Angina pain	1	0.4	100	0
Santalaceae	<i>Osyris lanceolata</i> Hochst. & Steud. SSS909	Mphera	Tree	Root	Dry	Pounded and mixed with dried powdered root of <i>M. sericea</i> . Taken orally with warm water. Thrice a day	Tuberculosis	1	0.4	100	0
Sapindaceae	<i>Dodonaea viscosa</i> Jacq. var. <i>angustifolia</i> (L.f.) Benth. SSS305	Mofentshe	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	11	5.4	100	0.05
Sapindaceae	<i>Pappaea capensis</i> Eckl. & Zeyh. SSS315	Moletha	Tree	Root	Dry	Pounded and taken orally with Honey®. Thrice a day	Sore throat	1	0.4	100	0
Sapotaceae	<i>Mimusops obovata</i> Nees ex Sond. SSS320	Mmupudu	Tree	Root	Dry	Mixed with (spider's web). Pounded and taken orally with warm water. Thrice a day	Tuberculosis	23	11.3	100	0.11
Scrophulariaceae	<i>Aptosimum lugardiae</i> (N.E.Br. ex Hemsl. & Skan) E. Phillips. SSS323	Selumi	Herb	Root	Dry	Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	3	1.4	100	0.01
Scrophulariaceae	<i>Buddleja salvifolia</i> (L.) Lam SSS329	Moketla	Shrub	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough	3	1.4	75	0.01
Solanaceae	* <i>Datura stramonium</i> L. SSS335	Mohlare-wa-stroke	Herb	Seed	Dry	Pounded and mixed with Vicks®. Mixture is used to	Tuberculosis	1	0.4	25	
							Chest pain	202	100	100	1

(continued on next page)

Table 1 (continued)

Botanical family	Species name and voucher numbers	Vernacular name	Habit	Used plant parts	State of use	Methods of herbal preparation and administration	Aliment/s treated	Frequency of use; n = THs (202)		FL	UV
								UM	%		
Solanaceae	<i>Solanum catombelense</i> Peyr. SSS1000	Mothola-o-momokhwibidu	Herb	Whole plant	Dry	massage (topically) painful chest Pounded and taken orally with warm water. Thrice a day	Chronic cough	202	100	100	1
Solanaceae	* <i>Solanum mauritanium</i> Scop. SSS316	Mothola-o-motala	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Headache	1	0.4	100	0
Solanaceae	<i>Solanum panduriforme</i> E.Mey. SSS326	Mothola-o-moserolwane	Herb	Root	Dry	Pounded and mixed with dried powdered root of <i>S. petersiana</i> . Taken orally with warm water. Thrice a day	Lack of appetite	1	0.4	100	0
Solanaceae	<i>Withania somnifera</i> (L.) Dunal SSS339	Mošalašupeng	Shrub	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough	66	32.6	100	0.32
Thymelaeaceae	<i>Lasiosiphon caffer</i> Meisn. SSS997	Nkekologe	Shrub	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Chronic cough Chest pain Sore throat Tight chest Tuberculosis	202 202 202 202 198	100 100 100 100 100	20 20 20 20 20	5
Urticaceae	<i>Pouzolzia mixta</i> Solms var. <i>mixta</i> SSS327	Moreswa	Tree	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	9	4.4	100	0.04
Velloziaceae	<i>Xerophyta retinervis</i> Baker SSS344	Thuse	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	1	0.4	100	0
Verbenaceae	* <i>Lantana camara</i> L SSS348	Sebabane	Shrub	Root	Dry	Pounded and taken orally with Cooking oil®. Thrice a day	Tuberculosis	1	0.4	100	0
Verbenaceae	<i>Lantana rugosa</i> Thunb. SSS324	Bokokotane/mokokotane	Shrub	Leaf	Fresh	Boiled for 5–10 minutes. Steam is inhaled (nasally) under blanket. Thrice a day	Tuberculosis	7	3.4	100	0.03
Verbenaceae	<i>Lippia javanica</i> (Burm.f.) Spreng. SSS710	Mošunkwane/motlaba-dipoo	Shrub	Leaf	Fresh	Boiled for 5–10 minutes. Steam is inhaled (nasally) under blanket. Thrice a day	Fever	202	100	96.6	1.03
						Boiled for 5–9 minutes. Extract is taken orally. Thrice a day	Tuberculosis	5	3.4	3.3	
						Mixed with fresh bulb of <i>S. aethiopicus</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1			
					Dry	Pounded and mixed with dried powdered root of <i>P. punctulata</i> . Taken orally with Cooking Oil®. Thrice a day	Tuberculosis	1			
Vitaceae	<i>Cyphostemma humile</i> (N.E.Br.) Desc. ex Wild & R.B.Drumm. subsp. <i>humile</i> SSS67	Sekgalaka	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	4	1.9	100	0.01
Vitaceae	<i>Cyphostemma woodii</i> (Gilg & M.Brandt) Desc. SSS709	Sekgalaka	Herb	Root	Dry	Pounded and mixed with dried powdered whole plant of <i>E. axillare</i> . Taken orally with warm water. Thrice a day	Tuberculosis	1	0.4	100	0
Vitaceae	<i>Rhoicissus tridentata</i> (L.f.) Wild & R.B.Drumm. subsp. <i>tridentata</i> SSS62	Terebe-ya-nageng	Herb	Root	Dry	Pounded and taken orally with warm water. Thrice a day	Tuberculosis	3	1.4	100	0.01
Zingiberaceae	<i>Siphonochilus aethiopicus</i> (Schweinf.) B.L.Burttt SSS20	Serokolo	Herb	Bulb	Fresh	Chewed (orally) as raw and sap is swallowed. Thrice a day	Chronic cough	13	55.9	69.3	0.8
						Boiled for 5–16 minutes. Extract is taken orally. Thrice a day	Chronic cough	100			
						Mixed with dried roots of <i>C. laureola</i> , <i>C. menyharthii</i> and <i>S. italica</i> , and fresh bulb of <i>D. elata</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1	24.7	30.6	
						Mixed with dried powered roots of <i>C. laureola</i> , and <i>Z. capense</i> , bark of <i>W. salutaris</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1			
						Mixed with dried powered root of <i>C. gratissimus</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1			

Zingiberaceae	*Zingiber officinale Roscoe SSS306	Motšintša	Herb	Rhizome	Fresh	Mixed with fresh leaf of <i>L. javanica</i> . Boiled for 5 minutes and extract is taken orally. Thrice a day	Tuberculosis	1
						Mixed with pounded dried root of <i>Z. capense</i> . Boiled for 5 minutes. Extract is taken orally. Thrice a day	Tuberculosis	1
						Mixed with fresh leaf of <i>C. sativa</i> . Macerated in warm water for 24 hrs. Decoction is taken orally. Thrice a day	Tuberculosis	1
						Boiled for 6–13 minutes. Extract is taken orally. Thrice a day	Tuberculosis	44
						Chopped and macerated in warm water for 1–4 hours. Decoction is taken orally. Thrice a day	Chronic cough	202
								100
								100
								1

Key: Exotic plant species: asterisk (*), fertility level; FL, use mention; UM and use value; UV.

of these species can be easily extracted and carried by hand without much effort.

3.3. Distribution of used plants within the municipalities and districts

Plant species (n = 184) documented in this study were analysed with respect to their utilisation by interviewed THs (n = 202) across the surveyed studied districts and municipalities (Supplementary Table 1). The most widely used species by all these healers constituted 17.9% (n = 33) of the total and included the following: *Acacia senegal*, *Adansonia digitata*, *Alepidea amatymbica*, *Aloe* spp., *Artemisia afra*, *Callilepis laureola*, *Cannabis sativa*, *Capparis tomentosa*, *Cassipourea garcini*, *Catha edulis*, *Citrullus lanatus*, *Clerodendrum ternatum*, *Combretum hereroense*, *Croton gratissimus*, *Cryptocarya transvaalensis*, *Datura stramonium*, *Dicoma anomala*, *Diospyros lycioides*, *Enicostema axillare*, *Eucomis pallidiflora*, *Gossypium herbaceum*, *Lasiosiphon caffer*, *Plumbago zeylanica*, *Psiadia punctulata*, *Securidaca longepedunculata*, *Strophanthus speciosus*, *Stylochaeton natalensis*, *Vernonia natalensis*, *Warburgia salutaris*, *Withania somnifera*, *Zanthoxylum capense*, *Zingiber officinale* as well as *Ziziphus zeyheriana*. This finding indicate that medical knowledge around these species is well-distributed within the Bapedi traditional healing sector, and that such species have been tested and validated by various THs against the broader spectrum of uses presented in Supplementary Table 1.

Knowledge of 2.7% (n = 5) of the species *Dichrostachys cinerea*, *Drimia elata*, *Peltophorum africanum*, *Schinus molle* and *Siphonochilus aethiopicus* (n = 5) were only known by a certain proportion of THs practicing within certain municipalities across the three studied districts. About 9.7% (n = 18) of species namely *Acacia erioloba*, *Acokanthera rotundata*, *Adenia spinosa*, *Buddleja salvifolia*, *Croton menyanthii*, *Cucumis zeyheri*, *Elephantorrhiza goetzei*, *Eucalyptus camaldulensis*, *Hypoxis hemerocallidea*, *Kirkia wilmsii*, *Melia azedarach*, *Mimusops obovata*, *Mundulea sericea*, *Myrothamnus flabellifolius*, *Portulaca oleracea*, *Protea caffra*, *Ricinus communis* and *Ziziphus mucronata* were reported by some THs sparsely distributed in some municipalities situated within two of three surveyed districts. The degree of utilisation of all the aforesaid species across the studied areas could be attributed to various factors including healer's limited\varying degree of knowledge with regard to their applications as medicines for TB and related symptoms. These can also be said for 16.3% (n = 30) of species namely *Adiantum capillus-veneris*, *Allium cepa*, *Allium sativum*, *Aptosimum lugardiae*, *Athrixia phyllicoides*, *Boscia albitrunca*, *Carissa bispinosa*, *Clematis brachiata*, *Clerodendrum glabrum*, *Combretum zeyheri*, *Cucumis metuliferus*, *Cyperus sexangularis*, *Cyphostemma humile*, *Dioscorea sylvatica*, *Dombeya rotundifolia*, *Elephantorrhiza burkei*, *Eriobotrya japonica*, *Euphorbia inaequilatera*, *Ficus abutilifolia*, *Grewia flava*, *Gymnosporia maranguensis*, *Lantana rugosa*, *Olea europaea*, *Pouzolzia mixta*, *Pristimera longipetiolata*, *Ptaeroxylon obliquum*, *Rhynchosia hirta*, *Senecio serratuloides*, *Tulbaghia violacea* and *Turraea obtusifolia* which were used by THs in the selected municipalities scattered within a single district.

The remaining plant species; which constituted the greatest proportion (53.2%, n = 98) of the entire suite of species documented in this study were utilised by some THs practicing in a single municipality located within one of the three studied districts (Supplementary Table 1). This finding therefore, indicates that sharing and exchanges of most information on medicinal plant knowledge pertinent to TB and related symptoms amongst Bapedi THs is very low.

3.4. Species utilisation

The 184 plant species used medicinally by interviewed Bapedi THs were used to treat TB as defined in this study and various related symptoms (Table 1). Amongst these medicinal plant species, 45.6% (n = 84) was utilised exclusively for TB. This suggests that such plants might

retain valuable healing ingredients active against *Mycobacterium tuberculosis*.

A total of 38 (20.6%) plants were implicated in treatment of TB and various related symptoms such as chronic cough, angina pain, sore throat, chest pain, fever, headache and lack of appetite. Furthermore, other species constituting this proportion treated TB and the following multiple conditions; chronic cough and fever, chronic cough and headache, chronic cough, chest pain and sore throat, angina pain and chronic cough, angina pain, chest pain, chronic cough and sore throat, chest pain, chronic cough and sore throat, chronic cough, chest pain and fever, angina pain, chest pain and chronic cough, chest pains, chronic cough and fever, angina pain and chest pain, chest pain, chronic cough, and lastly sore throat and tight chest. These conditions were considered by THs as highly prevalent in people/patients considered TB suspect. Multi-use of a single species as cure for TB and perceived related symptoms is a common practice amongst THs of other South African cultures such as Basotho (Phungula, 2015), and was also previously reported amongst THs of various ethnic groups in Nigeria (Mann et al., 2007). Overall, use of a single species to heal more than one condition as observed in our study could be a strong indicator of the natural availability of a variety of therapeutic phytochemicals within the implicated species that are effective against TB and all the foresaid conditions.

The rest of the plant species (33.6%, n = 62) recorded in the present survey were only used by Bapedi THs to treat symptoms such as angina pain, chest pain, chronic cough, sore throat, lack of appetite and headache in a person suspected to be infected with TB. In addition, some of these species were multi-used therapeutically for fatigue and lack of appetite, chronic cough and chest pain, chronic cough and headache, chest pain and angina pain, chronic cough, chest pain and fever. It is worth stating that the greater proportions of reported medicinal plants used by Bapedi THs as a cure for TB and all the aforesaid ailments has advantages from a therapeutic point of view because it widens the spectrum of treatment options. Subsequently, THs have options to choose the most accessible and effective treatment/s within the range of alternative available.

3.5. Literature comparison of the recorded species used for tuberculosis and related symptoms

It should be mentioned that of the 21 plant species documented in our previous study as anti-TB drugs by Bapedi THs (Semanya and Maroyi, 2013), the majority (n = 14) comprising of *Agapanthus inapertus*, *Artemisia afra*, *Cannabis sativa*, *Carica papaya*, *Citrus lemon*, *Combretum hereroense*, *Eriobotrya japonica*, *Eucalyptus camaldulensis*, *Eucomis pallidiflora*, *Hypoxis hemerocallidea*, *Lippia javanica*, *Myrothamnus flabellifolius*, *Salix mucronata* and *Zanthoxylum capense* were echoed as TB treatment by THs questioned in this study, thus authenticating information recorded. However, *Carica papaya* (chest pain), *Citrus lemon* (angina pain) and *Eucomis pallidiflora* (angina pain and chest pain) which were used as medicine for TB in our 2013 study are used here for the mentioned sicknesses in TB infected patients. The remaining species; *Aframomum melegueta*, *Chironia baccifera*, *Ficus carica*, *Ficus platypoda*, *Mentha* spp., *Merwillia plumbea* and *Pellaea calomelanos* noted by Semanya and Maroyi (2013), were not mentioned by THs questioned in the present study as part of TB therapy. This finding therefore, underlines the need to collect ethno-medicinal information from different participants in a follow-up study.

3.5.1. Tuberculosis therapies

Amongst the plant species (n = 82) documented in this study as TB medicines (Table 1), just six viz. *Combretum hereroense*, *Dicoma anomala*, *Enicostema axillare*, *Gossypium herbaceum*, *Stylochaeton natalensis* and *Ziziphus zeyheriana* were used by all interviewed THs (100%, n = 202, for each) across the studied districts and municipalities, thus suggesting that the active phytochemical constituents of these taxa might be sufficient to achieve the desirable therapeutic effects against

Mycobacterium tuberculosis. This postulation is attributed to the fact that plants are ethnomedically used in a recurring manner across the various geographical areas for similar ailments are more likely to be phytochemically active against the claimed uses (Semanya, 2012). To the best of our knowledge, with the exclusion of *C. hereroense* and *D. anomala*, medicinal applications of all the above-listed species against TB is presently restricted to Bapedi THs.

Comparison of the rest of the 82 species used by THs in this study exclusively as TB drugs with those reported in the literature for similar purposes was executed. Accordingly, the use of plant species (26.9%, n = 49) such as *Abutilon galpinii*, *Albizia adianthifolia*, *Acacia erioloba*, *Aptosimum lugardiae*, *Argemone ochroleuca*, *Blepharis diversispina*, *Cyphostemma humile*, *Cassinopsis ilicifolia*, *Cyphostemma woodii*, *Combretum zeyheri*, *Cucumis metuliferus*, *Cyperus sexangularis*, *Dioscorea dregeana*, *Dioscorea sylvatica*, *Eucomis autumnalis*, *Elephantorrhiza burkei*, *Euclea undulata*, *Ficus abutilifolia*, *Ficus ingens*, *Grewia bicolor*, *Gymnosporia maranguensis*, *Grewia flava*, *Senna occidentalis*, *Heteromopha arborescens*, *Ipomoea albivenia*, *Jatropha zeyheri*, *Kirkia wilmsii*, *Lantana rugosa*, *Mundulea sericea*, *Mimusops obovata*, *Ochna pulchra*, *Osyris lanceolata*, *Protea caffra*, *Pyrenacantha grandiflora*, *Pleurostyliya capensis*, *Portulacaria afra*, *Pristimera longipetiolata*, *Rhoicissus tridentate*, *Pouzolzia mixta*, *Rhynchosia hirta*, *Sorghum bicolor*, *Schottia brachypetala*, *Saccharum officinarum*, *Stachys aethiopica*, *Syzygium gerrardii*, *Tragia dioica*, *Tylosema fassoglense*, *Xerophyta retinervis* and *Zanthoxylum humile* were never reported previously in the literature, thus they are noted in our study for the first time. From an ethnopharmacological stand point, this finding is an indication that there may be many novel biologically active compounds (from plant resources) against TB yet to be discovered in South Africa or Africa as a continent. Scientific enquiries of the potential of the above-listed species as future sources of a new class of anti-tuberculosis drugs are crucial. This is imperative mainly in light of the increasing multidrug resistant, extensively drug resistant and totally drug resistant strains of *Mycobacterium tuberculosis* which render the current conventional TB therapies useless (Sloan et al., 2013).

Utilisation of the remaining species; *Adenia fruticosa*, *Agapanthus inapertus*, *Allium sativum*, *Burkea africana*, *Carpobrotus edulis*, *Combretum hereroense*, *Dicoma anomala*, *Pennisetum glaucum*, *Dichrostachys cinerea*, *Diospyros mespiliformis*, *Dodonaea viscosa*, *Eriobotrya japonica*, *Gymnosporia senegalensis*, *Hypoxis hemerocallidea*, *Helichrysum kraussii*, *Lantana camara*, *Melia azedarach*, *Myrothamnus flabellifolius*, *Olea europaea*, *Ptaeroxylon obliquum*, *Portulaca oleracea*, *Sclerocarya birrea*, *Senna occidentalis*, *Senecio serratuloides*, *Terminalia sericea*, *Tulbaghia violacea*, *Ximenia caffra*, *Waltheria indica* and *Ziziphus mucronata* by Bapedi THs for TB were either previously culturally authenticated in South Africa, other African countries or elsewhere. For instance, ethnobotanical use of *Carpobrotus edulis*, *Ptaeroxylon obliquum*, *Tulbaghia violacea*, *Ziziphus mucronata* (Lawal et al., 2014), *Hypoxis hemerocallidea* (Bhat, 2013) and *Portulaca oleracea* (Sewani-Rusike and Mammen, 2014) in the treatment of TB, was previously stated by the mentioned authors, amongst the Xhosa THs of Eastern Cape Province, South Africa. The latter species was also noted as being used for a similar ailment in North America (Antoun et al., 2001) and India (Jamil et al., 2004), thus suggesting that it is a widespread and popular TB medicine amongst various cultures of the world. Comparably to our findings, Vhavenda THs practicing in Vhembe district (Limpopo Province) also use *Allium sativum*, *Terminalia sericea*, *Ximenia caffra* (Green et al., 2010) and *Dodonaea viscosa* (Mativandlela, 2009) to treat this infection therapeutically. Overall, similarities with regard to the use of all the above-noted species amongst Bapedi THs and other South African cultures demonstrate that there is intra-cultural transfer/sharing of herbal knowledge pertinent to TB. The same can be said for *Combretum hereroense*, *Myrothamnus flabellifolius* (Watt and Breyer-Brandwijk, 1962), *Diospyros mespiliformis* (Lemmens et al., 2012), *Helichrysum kraussii* (Lourens et al., 2008) and *S. serratuloides* (Lall and Meyer, 1999) which were highlighted by the stated authors

as also being used curatively for TB by unspecified South Africans in unspecified locations.

To the best of our knowledge, ethnobotanical use of *Adenia fruticosa* (Fleurentin, 1991), *Burkea africana* (Bruschi et al., 2011), *Carissa bispinosa* (Neelo et al., 2015), *Dicoma anomala*, *Pennisetum glaucum* (Kose et al., 2015), *Dichrostachys cinerea* (Hurinanthan, 2009), *Gymnosporia senegalensis* (Nkwanyana, 2013), *Lantana camara* (Kirimuhuzya et al., 2009), and *Waltheria indica* (Ibekwe et al., 2014) as TB treatments are noted in the present study for the first time in South Africa, but were reported by the cited authors as highly utilised correspondingly to Bapedi in other African countries. Lack of South African literature reporting on the indigenous uses of the above-mentioned species for TB might be attributed to few ethnobotanical studies focusing on this infection. Medicinal uses of *Eriobotrya japonica* (Zhang et al., 2004), *Melia azedarach* (Azam et al., 2013), *Olea europaea* (Camacho-Corona et al., 2008) and *Senna occidentalis* (Reeta and Ravindra, 2013) in the treatment of TB is documented in our study for the first time in South Africa and Africa as a continent, however, these species were noted by the quoted researchers as also being used to heal TB outside Africa. Extracts from *Eriobotrya japonica* (Frisbey et al., 1953) and *Olea europaea* (Camacho-Corona et al., 2008) possess antimycobacterial activities, thus supporting its use by Bapedi THs.

3.5.2. Therapies for tuberculosis and related symptoms

As noted earlier, some of the plants were mentioned by interviewed THs as being multi-used for TB and its perceived opportunistic infections. Therefore, species used for TB and chronic cough included *Alepidea amatymbica*, *Adiantum capillus-veneris*, *Adenia spinosa*, *Buddleja salviifolia*, *Brachylaena transvaalensis*, *Callilepis laureola*, *Croton menyharthii*, *Clerodendrum ternatum*, *Dicerocaryum senecioides*, *Erythrina lysistemon*, *Garcinia gerrardii*, *Peltophorum africanum*, *Ricinus communis*, *Siphonochilus aethiopicus*, *Senna italica*, *Schinus molle*, *Strophanthus speciosus* and *Vernonia natalensis*. To the best of our knowledge, amongst these species only use of *A. amatymbica* and *P. africanum* was previously reported in South Africa as medicine for both diseases amongst Basotho THs (Phungula, 2015). The applications of *P. africanum* by Bapedi THs to cure TB and chronic cough were previously noted by Arnold and Gulumian (1984) and Green et al. (2010) for Vhavenda THs. Both Bapedi and Vhavenda THs share a similar geographical area (Limpopo Province), thus intercultural change of knowledge regarding the use of *P. africanum* as TB cure might have occurred. Additionally, safety of this species as an oral prescription (Bizimanyera et al., 2007), and its efficacy against *Mycobacterium tuberculosis* (Green et al., 2010) coupled with its wider natural distribution in Limpopo might have to some extent contributed to its use by Bapedi and Vhavenda THs for TB.

The medicinal uses of the remaining species used by Bapedi THs as chronic cough or TB are either noted in our study for the first in South Africa and Africa at large. As far as we know, medical knowledge of exotic *Schinus molle* as a chronic cough therapy is currently restricted to Bapedi THs in Africa, but used extensively for similar ailments by THs practicing in Peru (Hammond et al., 1998). However, use of *Schinus molle* in the management of TB is also common in unspecified western African countries (Orwa et al., 2009). Overall, restricted knowledge of this species as TB and a chronic cough drug to Bapedi in South Africa was expected. This is because Bapedi THs are amongst the very few known indigenous medical practitioners in the country who medicinally experiment with exotic species (Semanya et al., 2012). Similarly, use of another exotic *Ricinus communis* for TB and chronic cough medicine is presently practiced by these THs in Africa, but used for both these illnesses by THs in India (Ladda and Kamthane, 2014). To the best of our knowledge *Adiantum capillus-veneris* (Hutchings et al., 1996), *Callilepis laureola* (Ndhala et al., 2013), *Siphonochilus aethiopicus* (Van Wyk et al., 2002) and *Vernonia natalensis* (Nkwanyana, 2013) are recorded in this study for the first time as medicine for TB, but their uses in the treatment of cough was reported by the mentioned authors for Zulu

THs of South Africa. Lack of ethnobotanical knowledge of these species as TB drug amongst other cultures in South Africa and elsewhere show that Bapedi THs possess a unique herbal knowledge.

Plants such as *Allium cepa* (angina pain), *Croton gratissimus* (sore throat), *Drimis sanguinea* (chest pain), *Lippia javanica* (fever), *Securidaca longepedunculata* (headache) and *Senna petersiana* (lack of appetite) were multi-used by Bapedi THs to treat the mentioned ailments and TB. Comparison of these findings with published literature showed that only the use of *A. cepa*, *L. javanica* and *S. longepedunculata* for the above-stated ailments is common amongst other cultures of the world, and applications of the rest of the species as documented in this study is currently a Bapedi practice. Use of *A. cepa* as angina pain therapy is reported in South Africa and Africa at large for the first time in our survey, but used similarly to Bapedi in India (Kumar et al., 2010). Limited uses of *A. cepa* for angina pain in Africa might be attributed to its popularity as culinary species. As expected, medicinal applications of *L. javanica* as recorded in this study were comparable to other South African cultures including Vhavenda (Green et al., 2010) and Zulu (York et al., 2011). This finding came as no surprise due to both the popularity of *L. javanica* as a respiratory infections medicine across South Africa, and its effectiveness against *Mycobacterium tuberculosis* (Mujovo, 2009).

With regard to *Securidaca longepedunculata*, only its use for TB was previously reported in South Africa (Green et al., 2010), and its use as a headache reliever is currently restricted to Bapedi THs in this country. However, the species is widely prescribed by THs in Nigeria for headache (Mustapha, 2013). To the best of our knowledge, medicinal use of *Croton gratissimus* to alleviate fever and TB are recorded in South Africa for the first time in this study, but used similarly to Bapedi THs for both conditions in Namibia (Von Koenen, 2001).

Artemisia afra and *Psiadia punctulata* was multi-used in this study for chronic cough, fever and TB. The use of the first species for TB is in line with finding of Lawal et al. (2014) who worked with Xhosa THs of Eastern Cape (South Africa) and its use for chronic cough as well as fever is common in other African countries (Gemechu et al., 2013). As far as our literature search went, medicinal use of *P. punctulata* in the treatment of TB is noted in our study for the first time in South Africa and elsewhere. On the other hand, application of this species for chronic cough and fever were not found in South Africa. However, *P. punctulata* is a popular medicine for both ailments in African countries such as Botswana (Setshogo and Mbereki, 2011), and Kenya (Kokwaro, 1976).

Exotic species *Cannabis sativa* was used by Bapedi THs for chronic cough (Hutchings et al., 1996), headache (Du Toit, 1980), and TB (Lawal et al., 2014). A similar finding was previously reported by the cited authors amongst other South African cultures. Another alien plant, *Eucalyptus camaldulensis*, was implicated by the questioned Bapedi THs in the treatment of chronic cough, fever and TB. Use of this species for chronic cough and TB is also common amongst the Xhosa THs of the Eastern Cape Province (Lawal et al., 2014). No record of *E. camaldulensis* as a fever remedy was found in South Africa, thus its use is currently restricted to Bapedi THs. However, the Shona people of Zimbabwe utilise it comparably to Bapedi THs (Maroyi, 2011). Overall, extensive multi-utilisation of the aforesaid exotic species by Bapedi THs might be a reflection of their various bioactive compounds against the different reported claims compared to indigenous plants.

Plumbago zeylanica was appreciated by participants in the current study as medicine for chronic cough (Setshogo and Mbereki, 2011), chest pain, TB (Mungwini, 2006) and sore throat (Tyagi and Menghani, 2014), comparable results were noted by these researchers in other African countries. It should be stated that all (n = 202) interviewed Bapedi THs used *P. zeylanica* for chronic cough, sore throat and TB. This high consensus amongst Bapedi THs and other African cultures regarding uses of *P. zeylanica* indicates its potential as a source of future drugs against all the above-reported ailments.

The medicinal uses of most of the remaining species mentioned by Bapedi THs are mainly in harmony with either South African or other

African cultures. This includes *Clerodendrum glabrum* (angina pain, chronic cough and TB), *Warburgia salutaris* (angina pain, chest pain, chronic cough, sore throat and TB) and *Zanthoxylum capense* (chest pain, chronic cough, sore throat and TB) which were used for the mentioned ailments. Comparably to Bapedi, Zulu THs also exploit *C. glabrum* as cough medicine (Hutchings et al., 1996). Likewise, use of this species for TB was previously reported by Ferreira et al. (2012) amongst THs in Mozambique. Its use in the treatment of angina pain is reported in this study for the first time. Similarly, no ethnomedical use of *W. salutaris* in treatment of angina pain as reported by Bapedi THs was found in literature elsewhere. However, its uses by these THs for chronic cough (Bryant, 1966), chest complains, sore throat (Mabogo, 1990) and TB (Green et al., 2010) is also common amongst other South African cultures, thus indicating that *W. salutaris* is extensively known indigenous medicine for these ailments across South Africa. In our study, *W. salutaris* was used by all questioned THs (100%, n = 202) for the aforesaid ailments, excluding angina pain (1.9%, n = 4). Of all the reported medicinal uses of *Z. capense* by Bapedi THs, only its application for chest pain is reported for the first time in this study. The rest of the uses namely chronic cough (Bryant, 1966), TB (Steyn et al., 1998), and sore throat (Dyubeni and Buwa, 2012) is in harmony with findings of these authors who worked with the Zulu and Xhosa THs, respectively. This finding therefore validates the application of *Z. capense* by Bapedi THs as a treatment for the aforesaid afflictions. Furthermore, to some extent it suggests that Bapedi THs have knowledge of various healing properties of *Z. capense* and thus, are able to use them for range of specific ailments. It should be stated that this species was used by all (100%, n = 202) interviewed THs in this study as cure for all the above-stated ailments.

Medical applications of the remaining species namely *Acacia senegal* (chronic cough, chest pain and fever), *Carissa bispinosa* (angina pain, chest pain and chronic cough), *Cryptocarya transvaalensis* (chest pains, chronic cough and fever), *Drimys elata* (angina pain and chest pain) and *Lasiosiphon caffer* (chest pain, chronic cough, sore throat and tight chest) by Bapedi THs as multi-treatments of TB and the mentioned conditions are reported for the first time in this study. New medical applications of these species provide relevant contributions of novelty to the knowledge on plants implicated in TB and related symptoms in South Africa and elsewhere. Claims made by Bapedi THs on some of these species specifically *C. transvaalensis* and *L. caffer* which were used by all questioned THs (n = 202) for TB and the earlier alluded afflictions warrant further investigations with regard to their bio-active compounds. This is because one of the recognised evidences of efficacy and safety of herbal remedy is its widespread use for treating similar ailments (Wink and Van Wyk, 2004). In general, all species implicated by Bapedi THs as multiple cures for TB and other disorders could be of great importance and interest for further study with regard to their bio-active compounds.

3.5.3. Therapies for symptoms of tuberculosis

The remaining species (n = 62) recorded in this study were exclusively used by Bapedi THs to cure certain symptom/s encountered in patients suspected to be diagnosed with TB. Amongst these species, 8% (n = 5) were multi-used, and the remainder of the species (91.9%, n = 57) were used to treat a single disorder. Species which were multi-used comprised of *Adansonia digitata* (fatigue and lack of appetite), *Aloe marlothii* (chronic cough and chest pain), *Cucumis zeyheri* (chronic cough and headache), *Eucomis pallidiflora* (chest pain and angina pain) and *Monsonia angustifolia* (chronic cough, chest pain and fever). Comparison of these findings with previous studies revealed that only medicinal uses of *A. digitata* (fatigue), *A. marlothii* (chest pain) and *C. zeyheri* (chronic cough) for the mentioned diseases is common amongst other African cultures (Wickens, 1979; York et al., 2011; Hutchings et al., 1996). Medical knowledge pertinent to the use of the rest of all the above-listed species are presently restricted to Bapedi THs.

Plant species which were used by Bapedi THs to treat a single ailment included *Citrus limon* and *Salix mucronata* (angina pain), *Aloe falcata*, *Blepharis subvolubilis*, *Cassia abbreviata*, *Carica papaya*, *Datura stramonium*, *Euphorbia inaequilatera*, *Elaeodendron transvaalense*, *Helichrysum gymnocomum* and *Kleinia longiflora* (chest pain), *Athrixia phylicoides*, *Commiphora marlothii*, *Elephantorrhiza goetzei*, *Momordica balsamina*, *Leonotis leonurus*, *Morus alba*, *Musa sapientum*, *Philenoptera violacea*, *Pseudognaphalium luteo-album*, *Solanum catombelense*, *Sansevieria hyacinthoides*, *Senna didymobotrya*, *Turraea obtusifolia*, *Vigna frutescens*, *Withania somnifera*, *Zea mays* and *Zingiber officinale* (chronic cough), *Albizia anthelmintica*, *Acokanthera rotundata*, *Boscia albitrunca*, *Brackenridgea zanguebarica*, *Clematis brachiata*, *Capparis tomentosa*, *Dombeya rotundifolia*, *Commelina subulata*, *Citrullus lanatus*, *Diospyros lycioides*, *Ehretia rigida*, *Grewia sulcata*, *Ozoroa sphaerocarpa*, *Prunus persica*, *Solanum mauritianum* and *Vepris reflexa* (headache), *Citrus sinensis*, *Clivia caulescens*, *Catha edulis*, *Garcinia gerrardii*, *Grewia flavescens*, *Hypoxis obtusa*, *Panica granatum*, *Psidium guajava* and *Solanum panduriforme* (lack of appetite), and *Gymnosporia pubescens*, *Pappea capensis*, *Sida cordifolia* and *Zantedeschia aethiopia* (sore throat). Amongst these species *Albizia anthelmintica*, *Aloe falcata*, *Acokanthera rotundata*, *Blepharis subvolubilis*, *Boscia albitrunca*, *Brackenridgea zanguebarica*, *Clivia caulescens*, *Catha edulis*, *Garcinia gerrardii*, *Citrullus lanatus*, *Citrus limon*, *Commiphora marlothii*, *Commelina subulata*, *Diospyros lycioides*, *Elephantorrhiza goetzei*, *Euphorbia inaequilatera*, *Ehretia rigida*, *Elaeodendron transvaalense*, *Grewia flavescens*, *G. sulcata*, *Helichrysum gymnocomum*, *Hypoxis obtusa*, *Kleinia longiflora*, *Momordica balsamina*, *Ozoroa sphaerocarpa*, *Pseudognaphalium luteo-album*, *Prunus persica*, *Solanum catombelense*, *Senna didymobotrya*, *Sansevieria hyacinthoides*, *Salix mucronata*, *Solanum panduriforme*, *Turraea obtusifolia*, *Vigna frutescens* and *Vepris reflexa* have never been described and reported as stated remedies elsewhere.

Medical application of the remaining taxa as mentioned by Bapedi THs were either previously reported amongst different cultures in South Africa, other African countries, or elsewhere. For instance, use of *Athrixia phylicoides* (Mabogo, 1990), *Clematis brachiata* (Arnold and Gulumian, 1984; York et al., 2011), *Capparis tomentosa* (Arnold and Gulumian, 1984; Orwa et al., 2009), *Dombeya rotundifolia* (Van Wyk, 1972–1971; Reid et al. 2001), *Leonotis leonurus* (Van Wyk et al., 1997), *Philenoptera violacea* (Sewanu, 2012), *Solanum mauritianum* (Jager et al., 1996), *Withania somnifera* (Dold and Cocks, 2000) and *Zantedeschia aethiopia* (Van Wyk, 2008) as recorded in the present study were previously highlighted by the mentioned authors amongst other South Africa cultures. Our findings therefore, further accentuate the ethnomedical application of these species.

To the best of our knowledge, medical applications of the rest of the species use by Bapedi THs are either reported in this study for the first time in South Africa or in Africa at large. In this regards, use of *Carica papaya* (Aravind et al., 2013), *Cassia abbreviata* (Kokwaro, 2009), *Datura stramonium* (Watt and Breyer-Brandwijk, 1962), *Pappea capensis* (Wondimu et al., 2007) and *Zingiber officinale* and *Zea mays* (Focho et al., 2009) by interviewed Bapedi THs are documented in the present study for the first time in South Africa, but were reported by the cited authors as being used in a similar manner to Bapedi in other African countries. Similarly, knowledge of the medical applications of *Citrus sinensis* (Qureshi et al., 2011), *Morus alba* (Verger, 1995), *Musa sapientum* (Singh et al., 2013), *Panica granatum* (Khare, 2007) and *Psidium guajava* (Kabir et al., 2014) as recorded in our study are presently restricted to the interviewed Bapedi THs in Africa, but were reported by the mentioned authors as being used comparably to Bapedi in other countries of the world.

3.6. Fidelity level and use value

The documented medicinal plant species with the highest FL value were *Combretum hereroense*, *Dicoma anomala*, *Enicostema axillare* *Gossypium herbaceum*, *Stylochaeton natalensis* and *Ziziphus zeyheriana*

(use mention (UM) = 202 and FL = 100; TB, for each), *Capparis tomentosa*, *Citrullus lanatus* and *Diospyros lycioides* (UM = 202 and FL = 100; headache, for each), *Datura stramonium* (UM = 202 and FL = 100; chest pain), *Zingiber officinale* (UM = 202 and FL = 100; chronic cough), *Catha edulis* and *Cassipourea garcini* (UM = 202 and FL = 100; lack of appetite, for each), *Solanum catombelense* (UM = 202 and FL = 100; sore throat), *Dichrostachys cinerea* (UM = 197 and FL = 100; TB), and *Myrothamnus flabellifolius* (UM = 88 and FL = 100; TB), for the mentioned diseases.

Species which scored high on the use value index in this study include *Lasiosiphon caffer* (UV = 5; chest pain, chronic cough, sore throat, tight chest and TB), *Warburgia salutaris* (UV = 4.0; angina pain, chronic cough, chest pain, sore throat and TB), *Cryptocarya transvaalensis* (UV = 4; chest pain, chronic cough, fever and TB), *Plumbago zeylanica* (UV = 3.04; chronic cough, chest pain, sore throat and TB), *Zanthoxylum capense* (UV = 3.02; chronic cough, chest pain, sore throat and TB), *Acacia senegal* (UV = 3; chronic cough, chest pain and TB), *Artemisia afra* (UV = 3 fever, chronic cough and TB), *Psiadia punctulata* (UV = 3; chronic cough, fever and TB), *Alepidea amatymbica*, *Callilepis laureola*, *Clerodendrum ternatum*, *Strophanthus speciosus*, *Vernonia natalensis* (UV = 2; chronic cough and TB, for each), *Adansonia digitata* (UV = 1.12; fatigue and lack of appetite), *Croton gratissimus* (UV = 1.06; sore throat, and TB), *Securidaca longepedunculata* (UV = 1.04; headache and TB), *Aloe spp.* (UV = 1.03; angina pain, headache and TB), *Lippia javanica* (UV = 1.03; fever and TB), *Eucomis pallidiflora* (UV = 1.01; angina pain and chest pain), *Combretum hereroense*, *Dicoma anomala*, *Enicostema axillare*, *Gossypium herbaceum*, *Stylochaeton natalensis* and *Ziziphus zeyheriana* (UV = 1; TB, for each), *Datura stramonium* (UV = 1; chest pain), *Solanum catombelense* and *Zingiber officinale* (UV = 1; chronic cough, for each), *Cassipourea garcini* and *Catha edulis* (UV = 1; lack of appetite, for each), *Capparis tomentosa*, *Citrullus lanatus*, and *Diospyros lycioides* (UV = 1; headache) against the stated ailments. Most of these species appear to be the most preferred according to FL, suggesting that they are under extreme pressure of being harvested for medicinal usage.

3.7. Plant parts used, mode of preparations, dosages and administrations

Parts of the plant employed by Bapedi THs to make remedies for TB and its opportunistic conditions were mainly root (63.8%, n = 120), followed by leaf (13.8%, n = 26). Other used parts included bark and whole plant (4.7%, n = 9, for each), bulb (4.2%, n = 8), fruit, seed and tuber (2.1%, n = 4, for each), rhizome (1%, n = 2), stem and twig (0.5%, n = 1, for each), respectively. Four plant species was harvested by THs for more than one part. *Tabuti et al. (2010)* reported leaf and root as the most frequently sought parts of the plant by THs in Uganda for preparation of TB and related symptoms remedies. Contrary to the results of the present study, *Phungula (2015)* found that Basotho THs practicing in Free State Province (South Africa) distinctively prefer tubers. In a similar study but conducted amongst the Xhosa THs of Eastern Cape Province leaf were the most favoured plant part (*Lawal et al., 2014*). Remedial preparations made from this plant part were also dominant in a study conducted amongst THs in Gongo (*Ngbolua et al., 2014*). Variation with regard to the preferred plant part for medical preparations amongst Bapedi and the above-mentioned cultures might be attributed to the different cultural practices and availability of required plant part/s.

The majority of plant parts were processed in their dried state (84%, n = 158) compared to their fresh form (15.9%, n = 30). Four species were used in both these states. Preferences of preparing remedies from dried parts in this study might be due to the practice of preserving medicinal plant materials by THs for future usage. The limited use of freshly harvested plant parts is possibly because of the long distance travelled by THs to the species collection sites.

In general, a total of 275 recipes were documented as described by Bapedi THs during interview session. Most (71.2%, n = 196) of these

preparations involved the use of a single plant species, and those mixing different plants made-up just 28.7% (n = 79). The latter recipes were also the most prevalent in a study conducted amongst Basotho THs of Free State Province (*Phungula, 2015*). A comparable observation was reported in Nigeria (*Mann et al., 2007*) and Uganda (*Tabuti et al., 2010*). Polytherapies are repeatedly reported in literature as mainly used to increase effectiveness in the treatment of diseases (*Van Vuuren and Viljoen, 2008; Tsobou et al., 2013*). Thus, the availability of plant species and lack of THs' knowledge regarding the species combination might have partly contributed to the supremacy of monotherapy in this study. However, it should be stated that herbal medicine made from a single plant as observed in our study has advantage from a conservation stand point as it reduces the pressure of exploiting larger numbers of various species for polytherapy preparation.

Ethnomedicines/recipes used by Bapedi THs were predominantly prepared via boiling (50.9%, n = 140) and pounding (40.7%, n = 112). Some (2.1%, n = 6) recipes were made using both these methods. Other methods of recipe preparation recorded in the present study included burning (3.2%, n = 9), macerating (2.1%, n = 6) and chewing (2.1%, n = 2). *Phungula (2015)* also reported the prevalence of boiling and powdering for Basotho THs in Free State Province. Distinct preference for boiling medicinal plant materials by Bapedi THs might be due to the simplicity of technique, and their preferences for pounding materials is because it allows preservation of the materials for future usage. Limited usage of burning and maceration by Bapedi THs might be due to their long procedures. For instance, burning of medicinal plant materials is labor-intensive, THs have to cut some of these materials in to a very tiny pieces that can get lit first and ultimately burn the rest. Herbal preparation via maceration is time-consuming (e.g., it takes hours).

The most common method of drug administration by Bapedi THs for TB and related symptoms was oral (87.2%, n = 240), nasal (11.2%, n = 31) and topical (1.4%, n = 4), respectively. *Lawal et al. (2014)* also reported oral prescription as method of choice by Xhosa THs of Eastern Cape Province. Similar observations were noted amongst THs practicing in Congo (*Ngbolua et al., 2014*), Nigeria (*Ogbole and Ajaiyeoba, 2010*) and Uganda (*Tabuti et al., 2010*). In general, the diversity of routes of administering medicines in the present study is a reflection of intra-cultural variation amongst Bapedi THs which is attributed to the degree of an individual healer's preferences/practices and beliefs. Dosage consistencies amongst Bapedi THs were observed for oral prescriptions made via boiling. For instance, three metal cups (500 ml) of the extracts was dispensed thrice a day by all THs. However, dosage strength of the rest of the medicines depended on an individual healer's preferences and experience.

4. Conclusions

The present study contributes to a scanty knowledge of available South African and African literature that focuses on the documentation of plants used therapeutically by indigenous people to treat TB and allied symptoms. The long list of species recorded in this study for the first time in literature, as TB and perceived related symptoms medicines, provides valuable contributions to the ethnobotanical records of South Africa and elsewhere, and such a list also accentuates the need to conduct similar studies amongst other cultures. Similarities with regard to the use of some plant species amongst Bapedi THs and other indigenous people in South Africa and elsewhere, show safety and effectiveness of the implicated species as TB medications.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.sajb.2018.10.010>.

Acknowledgements

The author thanks traditional healers in the Capricorn, Sekhukhune and Waterberg districts of Limpopo Province, for sharing their ethnomedicinal indigenous knowledge related to the tuberculosis.

Declarations

Conflicts of Interest: None declared.

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