Ethnomedicinal Uses of Fabaceae Species for Respiratory Infections and Related Symptoms in the Limpopo Province, South Africa

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Abstract: *Purpose*: The present study investigated utilisation of Fabaceae species as herbal medicines for respiratory infections and related symptoms in the Limpopo Province, South Africa.

Methods: Information on Fabaceae species used as herbal medicines against respiratory infections was gathered using semi-structured questionnaires during face-to-face interviews with 240 Pedi speaking traditional healers (THs) from May to July 2017. Voucher specimens of utilized plant species were collected and their identities and scientific names authenticated by a plant taxonomist at the University of Limpopo's Larry Leach Herbarium.

Results: Twenty-five plant species belonging to 16 genera were used by THs in treating 13 respiratory infections. Majority of the species (64.0%, n=16) were multi-used while 36.0% (n=9) treated a single condition each. Plants which showed the highest fidelity level (FL) scores included *Acacia senegal* (chronic cough=FL; 32.8, chest pain=FL; 32.8, tuberculosis=FL; 32.8), *Dichrostachys cinerea* (tuberculosis= FL; 100) and *Acacia erioloba* (pneumonia=FL; 92.7). These species were also characterized by high use value (UV) indices of 2.5, 0.82 and 0.58, respectively.

Conclusion: Some of the plants recorded in this study are reported in literature to have potent biological activities against diverse pathogens which cause respiratory infections and perceived symptoms.

Keywords: Fabaceae, Limpopo province, medicinal plants, South Africa, traditional healers.

INTRODUCTION

Fabaceae family is the third largest plant family after Orchidaceae and Asteraceae in terms of the number of species with about 751 genera and 19000 species [1,2]. Majority members of this family are economically and culturally important throughout the world used as food, herbal medicines, timber and garden ornamentals. The role played by Fabaceae taxa in providing goods and ecosystem services is highlighted in studies conducted in different countries of the world such as in Argentina [3], Philippines [4] and Nepal [5,6]. In Africa such studies were conducted in Uganda [7], Kenya [8], Ethiopia [9], Zimbabwe [10] and South Africa [11-15]. However, there is dearth of information on ethnomedicinal uses of Fabaceae taxa amongst indigenous people in Africa. There are isolated cases where ethnopharmacological properties of Fabaceae species have been documented and these include reports that ethanol and ethyl acetate extracts of *Acacia nilotica* (L.) Delile exhibited activities against *Mycobacterium aurum* [16] corroborating the traditional use of the species for cough and tuberculosis (TB). *Acacia sieberiana* DC., traditionally used against fever and other respiratory infections exhibited activities against respiratory pathogens [17]. *Abrus precatorius* L., widely used as herbal medicine for asthma, bronchitis, chest, complaints, tuberculosis and whooping cough showed antibacterial activities against respiratory pathogens [18]. *Chamaecrista mimosoides* (L.) Greene, a species used to relieve chest pains and pneumonia exhibited activities against *Cryptococcus neoformans, Moraxella catarrhalis and Staphylococcus aureus* [19]. Other Fabaceae species used against respiratory infections and showed antibacterial activities include Millettia stuhlmannii *Taub., Parkinsonia aculeata* L., *Pterolobium stellatum* (Forssk.) Brenan, *Senna didymobotrya* (Fresen.) H.S. Irwin & Barneby, *Senna* occidentalis (L.) Link and Xanthocercis zambesiaca *(Baker) Dumaz-le-Grand* [20-23]. It is within this context that the current study was carried out aimed at documenting the utilization of Fabaceae species for respiratory infections by traditional healers practicing in the Limpopo Province, South Africa. Information recorded in the present study will provide baseline data required for future research in search for biological compounds required for the

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ISSN: 2223-3806 / E-ISSN: 1927-5951/18

development of pharmaceutical drugs and health promoting products.

MATERIAL AND METHODS

Study Area

The sites selected for this study were the municipalities of Capricorn, Sekhukhune and Waterberg districts of the Limpopo Province, South Africa (Figure **1**). These municipalities differ in size, with Capricorn covering a total area of 2 180 530 km^2 [24], Sekhukhune stretches up to 13 264 km^2 [25] while Waterberg is the largest municipality covering 4 951 882 km^2 [26]. Within each municipality, five villages, which are cultural home to the Pedi speaking people, were randomly selected as study areas. The vegetation types across the studied villages are characterized by species such as *Acacia erubescens* Welw. ex Oliv., *Combretum apiculatum* Sond. subsp. *Apiculatum, Terminalia sericea* Burch. ex DC., *Barleria lancifolia* T. Anderson, *Hirpicium bechuanense* (S. Moore) Roessler. and *Melhania rehmannii* Szyszyl.

Ethnobotanical Survey and Data Collection

Prior to data collection, a pilot study was conducted in each studied village to request permission from local traditional leaders to conduct the study within their area of governance and purposely select and request Pedi speaking traditional healers (THs) with experience of using plant species of the Fabaceae family as herbal medicine against respiratory infections to participate in the study. Information about knowledge of therapeutic plant use of Fabaceae taxa by THs (n=240) was gathered from May 2017 to July 2017 through semi-structured interviews and direct field observation after prior informed consent was obtained verbally from the participants. The majority of THs were females (n=136, 56.7%) while 43.3% were males (n=104), practicing as herbalists (58.7%, n=141), herbalists and diviners (40.5%, n=98), and diviners (0.4%, n=1). After interview section, an excursion was made to the homegardens and wilderness for species identification and specimen collection accompanied by TH. A taxonomist at the University of Limpopo's Larry Leach Herbarium confirmed the scientific names of collected specimens.

Data Analysis and Reporting

Ethnobotanical data on the medicinal use of Fabaceae were organized and analyzed via the Statistical Package for Social Sciences (SPSS), and subsequently, descriptive statistics were employed to establish frequency distribution and percentages.

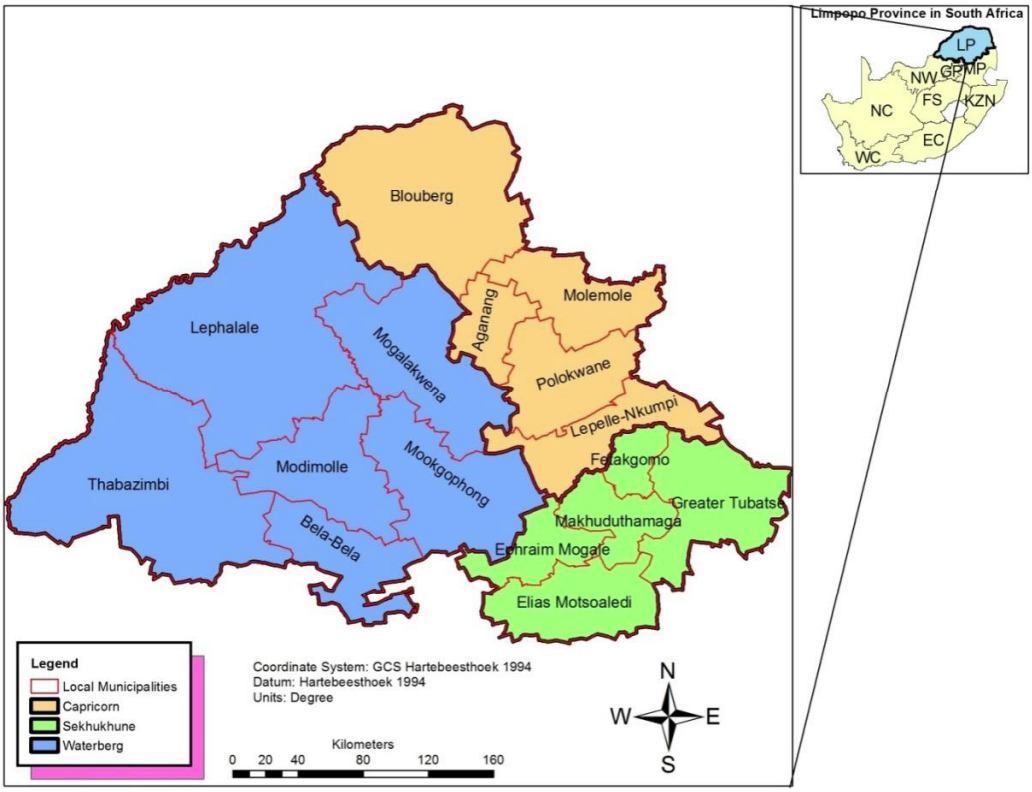

Figure 1: Map of Limpopo Province indicating the studied areas (districts and municipalities).

Fidelity level (FL) was used to determine the most trusted and preferred healing plants by THs for a specific respiratory infection. This was done by appraising the proportion of THs claiming the uses of a certain plant species to treat this infection. The method of Al-Quran [27] described below, was used to compute FL:

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

Where *Np* stands for the number of THs who claim use of a plant species to treat same respiratory infection, and *N* is the sum of THs who mentioned the use of species as a drug to treat any given respiratory infection. It worth stating that FL has some limitation as an analytical tool, simply because if a plant (A) has a low number of mentions (1-3) against a particular disorder, the FL can be high (100%) and in contrast plant (B) with more mentions may have a lower FL [28]. Therefore, to evade this, use mention (UM) value, that is, the sum of number mentioned by informants for a particular species use was obtained for each species used by THs for respiratory infection and correlated with FL. This was done to identify a healing plant with high FL. Overall a number of THs (n=15) interviewed in each studied municipality was used as a minimum benchmark to establish high UM of an individual species.

The use value (UV) indicate the importance of plant species known locally within a particular community or culture. Use value was determined in this study using the following formula previously employed by Phillips *et al*. [29]:

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

Where U is the number of use reports described by THs per species, while is the total N represented the total number of THs.

RESULTS AND DISCUSSION

Plant Diversity

Interview results and field observation showed that 25 plant species belonging to 16 genera were used to treat respiratory infections by THs in the Limpopo province of South Africa. Although our study is the first of its kind, it should be stated that classical literature, exist reporting on the utilization of the Fabaceae in the treatment of various human ailments in other areas of the world. For instance, Padal *et al*. [30] who conducted a study in Visakhapatnam district, Andhra Pradesh, India reported that 15 species belonging to Fabaceae were used as abortifacient, abscess, alopecia, anthelmintic, backache, boil, cough, dandruff, earache, eye clarity, jaundice, migraine, skin disease and wounds. In Bangladesh, 32 species were used for abscess, asthma, cough, cold, dysentery, ulcers and leprosy (Rahman and Parvin, 2014). Similarly, Molares and Ladio [3] reported that 19 Fabaceae species were used as medicines in Argentine and Chilean Patagonia. These studies demonstrate how indigenous people throughout the world rely on species of Fabaceae family as sources of herbal medicines. The 25 species recorded in this study provide THs with therapeutic materials needed for treating and managing various respiratory diseases in the Limpopo province (Table **1**). The majority of plants used were trees (64%, n=16), followed by herbs (20%, n=5) and shrubs (16%, n=4) (Table **1**). Majority of plants (76.0%, n=19) recorded in this study were collected from the wild while 20.0% (n=5) namely *Erythrina lysistemon*, *Peltophorum africanum*, *Senna didymobotrya, Senna petersiana* and *Tylosema fassoglense* were collected from homegardens. *Cassia abbreviata* (4%, n=1) was the only species collected from both sources.

The 25 species were used to treat and manage 13 respiratory infections and perceived related symptoms such as aphonia, asthma, chest pain, chronic cough, fatigue, headache, lack of appetite, pneumonia, sinusitis, sore throat, tight chest, tuberculosis and wheezing. Majority of the species (64%, n=16) were multi-used while the rest (36%, n=9) were used to treat a single ailment each, viz. *Acacia tortilis* (sinusitis), *Albizia anthelmintica* (headache), *Burkea africana* (tuberculosis), *Dichrostachys cinerea* (tuberculosis), *Rhynchosia hirta* (tuberculosis), *Senna didymobotrya* (chronic cough), *Tylosema esculentum* (headache), *Tylosema fassoglense* (tuberculosis) and *Vigna frutescens* (chronic cough). The majority of the species (56.0%, n=14) were used as herbal medicines for tuberculosis (Table **1**). This finding is not surprising since the Limpopo province is characterized by high prevalence of tuberculosis [31,32]. Other diseases that were treated by large number of species included chronic cough (36.0%, n=9), followed by asthma (28.0%, n=7) and pneumonia (24.0%, n=6), thus suggesting that these disorders might be common health care issues in the province. The opposite can be said concerning the remaining ailments, namely lack of appetite, sinusitis and sore throat (16.0%, n=4, each), fatigue and headache (12.0%, n=3 each), chest pains

Table 1:

Species name	Vernacular name	Habit	Part used	Methods of herbal preparation and administration	Aliments treated	Ethnomedicinal indexes			Reported pharmacological activities
						UM	FL (%)	UV	
Acacia erioloba E.Mey.	Mogohlo/Mošu	Tree	Root	Pounded and mixed with dried powdered bark of *Peltophorum africanum* and *Sclerocarya birrea* (Anacardiaceae) and root of *Ximenia caffra* (Olacaceae). Taken orally with warm water thrice a day.	Asthma	1	0.7	0.58	Tannins, saponins, sterols and antibacterial activities against *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* [33]
				Pounded and taken orally with warm water. Thrice day.	Pneumonia	128	92.7		
					Tuberculosis	9	6.5		
Acacia sieberiana DC. var. *woodii* (Burtt Davy) Keay & Brenan	Mošu	Tree	Root	Pounded and taken orally with warm water thrice a day.	Asthma	1	100	0.00	Alkaloids, flavonoids, steroids and tannins triterpenes [41] and antibacterial activities against *Staphylococcus aureus* [42]
				Pounded and mixed with dried powdered root of *Englerophytum magalismontanum* (Sapotaceae) and bark of *Sclerocarya birrea*. Burned and smoke is inhaled nasally thrice a day	Headache	1	100		
Acacia senegal (L.) Willd. var. *rostrata* Brenan	Mokgaripe	Tree	Root	Boiled for 6 -11 minutes and extract taken orally thrice a day	Asthma	2	0.3	2.5	Antibacterial activities against *Staphylococcus aureus* [43] and *Klebsiella pneumoniae* [44]
					Chronic cough	202	32.8		
					Chest pain	202	32.8		
					Sinusitis	4	0.6		
					Sore throat	3	0.4		
					Tuberculosis	202	32.8		
Acacia tortilis (Forssk.) Hayne subsp. *heteracantha* (Burch.) Brenan	Mošhwana	Tree	Root	Boiled for 5 minutes and steam inhaled nasally under blanket thrice a day	Sinusitis	11	100	0.04	Antibacterial activities against *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus pyogene*, alkaloid, flavonoid, phenol, saponin, tannin and volatile oil [45]
Albizia adianthifolia (Schumach.) W.Wight var. *adianthifolia*	Mafahla-nare	Tree	Root	Boiled for 5-12 minutes and extract taken orally thrice a day or pounded and taken orally with warm water thrice a day	Aphonia	8	53.3	0.06	Antibacterial activities against *Bacillus subtilis*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* [46]
					Fatigue	3	20		
					Tuberculosis	4	26.6		
Albizia anthelmintica (A.Rich.) Brongn	Mohlaphuhla	Tree	Root	Burned for about 4-6 seconds and smoke is inhaled nasally thrice a day	Headache	13	100	0.05	Alkaloids, anthraquinone, diterpenes, flavonoids, phenolics, saponins and tannins [47], and antibacterial activities against *Bacillus subtilis* and *Staphylococcus aureus* [48]

(Table 1). Continued.

Species name	Vernacular name	Habit	Part used	Methods of herbal preparation and administration	Aliments treated	Ethnomedicinal indexes			Reported pharmacological activities
						UM	FL (%)	UV	
Burkea africana Hook.	Monatlo	Tree	Root	Boiled for 4 minutes and extract taken orally thrice a day	Tuberculosis	1	100	0.00	Tannins, saponins, terpenoids and antibacterial activities against *Salmonella typhi* and *Staphylococcus aureus* [49]
Cassia abbreviata Oliv. subsp. *beareana* (Holmes) Brenan	Monepenepe	Tree	Bark	Boiled for 5-9 minutes and extract taken orally thrice a day	Asthma	3	14.2	0.09	Antibacterial activities against *Bacillus subtilis* and *Staphylococcus aureus* [50]
					Chest pain	10	47.6		
					Sore throat	3	14.2		
					Fatigue	2	14.2		
				Mixed with fresh bulb of *Drimia elata* (Hyacinthaceae), and dried root of *Maerua juncea* (Capparaceae), boiled for 6 minutes and extract taken orally thrice a day	Fatigue	1			
				Pounded and mixed with dried powered root of *Cucumis zeyheri* (Cucurbitaceae) and taken orally with soft porridge thrice a day	Lack of appetite	1	4.7		
				Pounded and mixed with dried powered bark of *Sclerocarya birrea* and fresh bulb of *Drimia sanguinea* (Hyacinthaceae), boiled for 6 minutes and extract taken orally thrice a day	Pneumonia	1	4.7		
Dichrostachys cinerea (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt var. *africana*	Moselesele/ Moretšhe	Tree	Root	Boiled for 7-10 minutes and extract taken orally thrice a day	Tuberculosis	197	100	0.82	Alkaloids, diterpenes, flavonoid, phytosterols, tannis and triterpenes [51] and antimycobacterial activities against *Mycobacterium tuberculosis* [34]
Elephantorrhiza burkei Benth.	Mošišane/Batswetsi	Shrub	Root	Pounded and mixed with dried powdered stem of *Adenia spinosa* (Passifloraceae) and root of *Peltophorum africanum* and taken orally with warm water thrice a day	Fatigue	1	25	0.05	Flavonoids, glycosides, polysterols, saponins, sugars, tannins and triterpenoids, and antibacterial activities against *Bacillus subtilis*, *Mycobacterium aurum* and *Staphylococcus aureus* [52]
				Boiled for 5-8 minutes and extract taken orally thrice a day	Fatigue	2			
					Asthma	3	25		
					Tuberculosis	6	50		
Elephantorrhiza goetzei (Harms) Harms subsp. goetzei	Mošitšane	Shrub	Root	Boiled for 3-6 minutes and extract taken orally thrice a day	Chronic cough	6	85.7	0.02	Stilbenoid and triterpenoids and, antibacterial activities against *Bacillus subtilis* and *Staphylococcus aureus* [53]
				Mixed with fresh bulb of *Eucomis autumnalis* (Hyacinthaceae), boiled for 6 minutes and extract taken orally thrice a day	Fatigue	1	14.2		

(Table 1). Continued.

Species name	Vernacular name	Habit	Part used	Methods of herbal preparation and administration	Aliments treated	Ethnomedicinal indexes			Reported pharmacological activities
						UM	FL (%)	UV	
Erythrina lysistemon Hutch.	Sebalo/Mmale	Tree	Bark	Boiled for 5-8 minutes and extract taken orally thrice a day	Sore throat	5	23.8	0.09	Erythrinaline alkaloids and flavonoids, and antibacterial activities against *Bacillus subtilis* and *Staphylococcus aureus* [54]
					Wheezing	10	47.6		
					Chronic cough	3	19		
				Pounded and mixed with dried powdered root of *Carissa bispinosa* (Apocynaceae) and taken orally with warm water thrice a day	Chronic cough	1			
					Sinusitis	1	4.7		
					Tuberculosis	1	4.7		
Indigofera circinnata Benth. ex Harv.	Molomomonate o-o-monyane/Mohlaswapelo	Shrub	Root	Pounded and taken orally with warm water thrice a day	Chronic cough	9	30	0.13	Antifungal activity against *Cryptococcus neoformans* [55]
					Sore throat	3	10		
					Lack of appetite	18	60		
Mundulea sericea (Willd.) A.Chev. subsp. *sericea*	Mošitatlou	Tree	Root	Pounded and mixed with dried powdered root of *Osyris lanceolata* (Santalaceae) and taken orally with warm water	Tuberculosis	1	100	0.01	Sesquiterpenes and antibacterial activities against *Bacillus cereus, Bacillus megaterium* and *Staphylococcus aureus* [56]
Peltophorum africanum Sond.	Mosehla	Tree	Bark	Pounded and mixed with dried powered leaf of *Artemisia afra* (Asteraceae) and taken orally with Syrup® thrice a day	Asthma	1	6.2	0.2	Benzenoids, coumarins, flavonoids and terpenes and antibacterial activities against *Staphylococcus aureus Streptococcus pyogenes* and *Klebsiella pneumonia* [35]
				Pounded and mixed with dried powdered root of *Berchemia discolor* (Rhamnaceae) and *Senna italica,* and dried bark of *Sclerocarya birrea,* poured in boiling water and steam inhaled nasally under blanket thrice a day	Asthma	1			
				Pounded and mixed with dried powdered roots of *Acacia erioloba*, *Ximenia caffra* and dried bark of *Sclerocarya birrea* and taken orally with warm water thrice a day	Asthma	1			
				Boiled for 5-11 minutes and extract taken orally thrice a day	Chronic cough	18	37.5		
					Sinusitis	7	14.5		
					Sore throat	1	2		
					Pneumonia	2	4.1		
					Tight chest	6	12.5		
					Fatigue	10	22.90		
			Root	Pounded and mixed with dried powdered stem of *Adenia spinosa* and a root of *Elephantorrhiza burkei* and taken orally with warm water thrice a day	Fatigue	1			

(Table 1). Continued.

Species name	Vernacular name	Habit	Part used	Methods of herbal preparation and administration	Aliments treated	Ethnomedicinal indexes			Reported pharmacological activities
						UM	FL (%)	UV	
Philenoptera violacea (Klotzsch) Schrire	Mphata	Tree	Bark	Boiled 5-10 minutes and extract taken orally thrice a day	Chronic cough	13	76.4	0.07	Alkaloids, cardiac glycosides, flavonoids, steroids, tannins and terpenoids [57]
					Pneumonia	4	23.5		
Rhynchosia hirta (Andrews) Meikle & Verdc.	Terebe-ya-nageng	Herb	Root	Pounded and taken orally with warm water thrice a day	Tuberculosis	19	100	0.08	-
Schotia brachypetala Sond.	Molope	Tree	Root	Boiled for 4-10 minutes and extract taken orally thrice a day	Lack of appetite	4	44.4	0.04	Antibacterial activities against *Bacillus subtilis*, *Staphylococcus aureus, Escherichia coli* and *Klebsiella pneumoniae* [58]
				Pounded and mixed with dried powdered bark of *Sclerocarya birrea* and root of *Vangueria infausta* (Rubiaceae) and taken orally with warm water thrice a day	Pneumonia	1	11.1		
				Boiled and extract taken orally thrice a day	Tuberculosis	4	44.4		
**Senna didymobotrya* (Fresen.) H.S. Irwin & Barneby	Moroteladitšhoši-o-mogolo	Shrub	Root	Pounded and taken orally with warm water thrice a day	Chronic cough	8	100	0.03	Alkaloids, flavonoids, phenols, saponins, steroids, tannins and terpenoids, and antibacterial activities against *Staphylococcus aureus* and *Streptococcus pyrogenes* [59]
Senna italica Mill. subsp. *arachoides* (Burch.) Lock	Moroteladitšhoši	Herb	Root	Pounded and mixed with a dried powdered roots of *Berchemia discolor,* dried bark of Sclerocarya *birrea* and *Peltophorum africanum,* poured in boiling water and steam inhaled nasally under blanket thrice a day	Asthma	1	39.1	0.10	Alkaloids, flavonoids, phenols, steroids and terpenoids [60]
				Boiled for 4-8 minutes and extract taken orally thrice a day	Asthma	8			
					Sinusitis	5	21.7		
					Chronic cough	4	17.3		
				Mixed with dried roots of *Callilepis laureola* (Asteraceae), *Croton menyharthii* (Euphorbiaceae) and fresh bulbs *Drimia elata* (Hyacinthacee) and *Siphonochilus aethiopicus* (Zingiberaceae), boiled for 5 minutes and extract taken orally thrice a day	Tuberculosis	1	8.6		
				Pounded and taken orally with warm water thrice a day	Tuberculosis	1			
				Pounded and mixed with dried powered root of *Cyperus sexangularis* (Cyperaceae) and taken orally with warm water thrice a day	Fatigue	2	8.6		
				Pounded and mixed with dried powdered root of *Cyphostemma humile* (Vitaceae), poured in warm water and used topically as a bath thrice a day	Pneumonia	1	4.3		

(Table 1). Continued.

Species name	Vernacular name	Habit	Part used	Methods of herbal preparation and administration	Aliments treated	Ethnomedicinal indexes			Reported pharmacological activities
						UM	FL (%)	UV	
Senna occidentalis (L.) Link	Moroteladitšhoši-omogolo	Tree	Root	Boiled for 5 minutes and extract taken orally thrice a day	Chronic cough	6	75	0.03	Alkaloids, anthraquinones, glycosides, phenols, reducing sugar, saponins and tannins, and antibacterial activities against *Klebsiella pneumoniae* and *Staphylococcus aureus* [61]
					Tuberculosis	2	25		
Senna petersiana (Bolle) Lock	Monepenene	Tree	Root	Pounded and mixed with dried powdered root of *Solanum panduriforme* (Solanaceae) and taken orally with warm water thrice a day	Lack of appetite	1	50	0.00	Antibacterial activities against *Staphylococcus aureus* [62]
				Pounded and mixed with dried powdered fruit of *Cucumis zeyheri* (Cucurbitaceae) and taken orally with warm water thrice a day	Tuberculosis	1	50		
Tylosema esculentum (Burch.) A. Schreib.	Monoga/Noga-koto	Herb	Root	Pounded and taken orally with warm water thrice a day	Headache	1	100	0.00	Fatty acid, phytosterols, lignans and peptides and antibacterial activities against *Mycobacterium terrae* and *Staphylococcus aureus* [63]
Tylosema fassoglense (Schweinf.) Torre & Hillc.	Monoga	Herb	Root	Pounded and taken orally with warm water thrice a day	Tuberculosis	12	100	0.05	-
Vigna frutescens A.Rich. subsp. *frutescens* var. *frutescens*	Moraranwe	Herb	Root	Boiled for 5-9 minutes and extract taken orally thrice a day	Chronic cough	3	100	0.01	Antibacterial activities against *Bacillus cereus*, *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* [64]

(8.0%, n=2), aphonia, tight chest and wheezing (4.0%, n=1 each).

Fidelity Level (FL) and Use Value (UV)

Members of the Fabaceae family which showed the greatest FL included *Acacia senegal* (chronic cough=UM; 202 and FL; 32.8, chest pain= UM; 202 and FL; 32.8, tuberculosis=UM; 202 and FL; 32.8), *Dichrostachys cinerea* (tuberculosis=UM; 197 and FL; 100), *Acacia erioloba* (pneumonia=UM; 128 and FL; 92.7), *Rhynchosia hirta* (tuberculosis= UM; 19 and FL; 100), *Indigofera circinnata* (lack of appetite=UM; 18 and FL; 60) and *Peltophorum africanum* (chronic cough=UM; 18 and FL; 37.5). This high level of consensus amongst THs regarding the therapeutic applications of these species against the stated ailments may indicate the healing properties of such taxa. The highest UV values were recorded for *Acacia senegal,* used multi-purposely for asthma, chest pain, chronic cough, sinusitis, sore throat and tuberculosis (UV=2.5) (Table **1**). This species could be considered to be relatively important as herbal medicine against respiratory infections in the province. Such species should be considered as priorities for management and conservation since the species was collected from free access communal lands. Mono-purpose species such as *Dichrostachys cinerea* had high UV (0.82) scores, followed by *Acacia erioloba* (UV=0.58) used as multiple-therapy against asthma, pneumonia and tuberculosis (Table **1**).

Ethnopharmacological literature review on some of the afore-mentioned species revealed that the species have bioactive principles and are characterized by several pharmacological properties. For instance, ethanol and methanol stem bark extracts of *Acacia erioloba* exhibited antibacterial activity against *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* strains [33]. Same authors also identified tannins, saponins and sterols in the stem bark extracts of the species. *Dichrostachys cinerea* extracts demonstrated anti-tuberculous activities which could be attributed to the presence of bioactive compounds such as alkaloids, diterpenes, flavonoid, phytosterols, tannis and triterpenes [34]. Similarly, Peltophorum africanum bark and root extracts exhibited antibacterial activities against the respiratory infections strains Staphylococcus aureus, Streptococcus pyogenes and Klebsiella pneumoniae [35].

Plant Parts Used, Methods of Remedy Preparation and Administration

Roots and bark were the only plant parts used to prepare medicine for respiratory infections and related symptoms. Roots were harvested from 80% of the species while bark was obtained from 12.0% of the species (Table **1**) while both roots and bark of *Peltophorum africanum* were used. Forty-seven herbal remedies were recorded in this study, of which the majority (57.5%, n=27) were prepared from a single plant species. Medicines prepared from multiple plants contributed 42.5% (n=20) and comprised members of the Fabaceae family and other botanical families (Table **1**). This practice has potential to ensure extraction of diverse bioactive compounds effective against different respiratory infections and related symptoms. According to Carović-Stanko [36], each species from a particular floral family has a unique and complex mixture of bioactive compounds in which each component contributes to its overall bioactivity. Remedies were mainly prepared via pounding (n=23) and boiling (n=19). The utilization of these techniques in herbal preparation using the Fabaceae taxa is well documented in African ethnobotanical literatures [37-40]. However, in rare instances, some medicines were prepared using both pounding and boiling (n=3) methods. Similarly, one recipe (n=1) was made via pounding and burning, and the other exclusively via burning (n=1). The principal methods of administering medicines were orally (n=41), nasally (n=5) and topically (n=1) (Table **1**).

CONCLUSION

The present study provides base-line information regarding the utilisation of Fabaceae species in the treatment of respiratory infections in the Limpopo province in South Africa. The large number of plant species used are known to contain bioactive compounds which have demonstrated diverse pharmacological properties against several disease causing pathogens. Results of this study provide a scientific rationale for utilization of indigenous knowledge about Fabaceae taxa that are effective against respiratory infections and related conditions in search for new therapeutic drugs and health care products against these health problems.

AUTHORS' CONTRIBUTIONS

SSS conducted field work and wrote the first draft while AM supervised the research and assisted with data analysis and writing the manuscript.

CONFLICT OF INTEREST

No conflict of interest is associated with this work.

ACKNOWLEDGMENTS

The author would like to express his gratitude to the National Research Foundation, South Africa (NRF) and Govan Mbeki Research and Development Centre (GMRDC), University of Fort Hare for financial support to conduct this study.

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Received on 10-08-2018 Accepted on 07-09-2018 Published on 30-11-2018

DOI: https://doi.org/10.29169/1927-5951.2018.08.04.10