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AN ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS USED IN VILLAGES UNDER JONGILANGA TRIBAL COUNCIL, MPUMALANGA, SOUTH AFRICA

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Abstract

Background: Medicinal plants remain an integral part of the lives of people in rural areas. The aim of this study was to document information about the medicinal plants used by Shangaan people in villages under Jongilanga tribal council, Bushbuckridge municipality, Mpumalanga Province, South Africa.
Materials and Methods: An ethnobotanical survey of medicinal plants was conducted using a semi-structured questionnaire with 15 traditional healers as informants; one of them also served as a field guide during data collection. Results were analysed by using various quantitative indices of information consensus factor (ICF), use report (UR), frequency citation (FC) and relative frequency citation (RFC).
Results and Methods: The study reported 86 medicinal plants used in villages for the treatment of various ailments, the majority (25 species) of which were used for urino-genital disorders. The Fabaceae family was the most represented family (17 species) of all the medicinal plants recorded in this study. The roots were the most frequently used plant part, accounting for 56% of the plants reported, and decoctions were often used in the preparation of herbal remedies. Respiratory diseases had the highest ICF value recorded among the 8 categories of ailments. The highest use report was reported for *Combretum collinum* (4), while the FC and RFC values (15) were highest in 12 plant species. The study revealed that medicinal plants are still widely used in rural areas and this documentation can serve as an ethno pharmacological basis for selecting plants with potential pharmaceutical properties.

Keywords: Medicinal plants, Traditional healers, Jongilanga

Introduction

With over hundreds of years in existence, traditional medicine is still widely used, Africa. Many countries have made great efforts to recognize traditional medicine as a health system which plays an important role especially in poor households (Abdullahi, 2011). Traditional medicine is sometimes the only easily accessible and affordable treatment available in many rural areas in developing countries. There is a long history of medicinal plant use on the African continent and in some countries up to 90% of the population rely on medicinal plants as a source of therapeutics (Glenn and Bussmann, 2010; Simbo, 2010; Mesfin et al., 2009).

Traditional medicine knowledge is diminishing in many rural communities. Therefore, its documentation is of paramount importance and urgent so that it can be preserved and conserved (Maroyi, 2012). Traditional knowledge is passed from generation to generation without the aid of any documentation or keeping written records. This knowledge will be lost with succeeding generations if it is not rapidly researched and recorded (Simbo., 2010). Ethnobotanical surveys are effective methods in documenting and identifying medicinal plants used in traditional knowledge system (Mahwasane et al., 2013). The purpose of this study was to document information about medicinal plants' used in villages under Jongilanga tribal council, Mpumalanga province, South Africa. According to the authors' knowledge, this study will present the first proper documentation of medicinal plants in this area.

Material and Methods

Study area

Mpumalanga is one of the nine South African provinces within the Maputaland-Pondoland region, harbouring the southern half of the Kruger National Park and other centres of endemism. Mpumalanga is divided into three districts, namely the Gert Sibande district, Nkangala district and Ehlanzeni district. The Ehlanzeni district municipality is located in the north-eastern part of Mpumalanga Province bordered by Mozambique and Swaziland. The Ehlanzeni district municipality covers an area of 27 895.47 km^2. Thus, the district is divided into the local municipalities Mbombela, Nkomazi, Bushbuckridge, Umjindi, and Thaba Chweu (Figure 1). The Bushbuckridge local municipality covers an area of 2 589.59 km^2 with Dwarsloop, Thulamahashe, Maviljan, Shatate, Mkhuhlu and Marite being the main townships. The rest of the geographical area in Bushbuckridge is made up of villages (Mpumalanga provincial government, 2011). The dominant languages in Mpumalanga include Siswati (30%), a language from the neighbouring country, Swaziland; while 26% of the inhabitants speak isiZulu, 10.3% isiNdebele, 210.2% Northern Sotho and 11.6% Xitsonga.

The Jongilanga tribal council (GPS coordinates: S 24° 53' 35.52") falls under Bushbuckridge local municipality and controls about 14 villages (Agincourt, Belfast, Croquet Lawn, Cork, Cunningmoor, Dumphries, Huntingdon, Justicia, Kildare, Lillydale, Ronaldsey, Oakley and Somerset) where this study was conducted. Most people in these villages speak Xitsonga, but they can also speak other provincial languages (www.bushbuckridge.gov.za).

Figure 1: Map of Mpumalanga showing location of the study area (circled).

Ethnobotanical data collection

This study focused on indigenous medicinal plants used by traditional healers in villages that fall under the Jongilanga tribal council. All legal aspects of the study were adhered to before data collection. The investigation was carried out using questionnaires designed to facilitate semi-structured face-to-face interviews with traditional healers. The objectives of the study were explained before seeking their consent to engage in these interviews. This interaction was directed at recording information on medicinal plants used locally, local names of plants, plant parts used to treat various ailments, medicinal uses and preparation methods. Fifteen traditional healers were interviewed during six field visits between April 2011 and April 2013. Mr. Mahore, a traditional healer from one of the villages within the Jongilanga traditional council, was also used as a guide during field trips to collect plant material.

Voucher specimens of collected medicinal plants were prepared in the field and identified at the H.G.W.J. Schwelcherdt herbarium (PRU), University of Pretoria. Some of the plant species were taken to the South African National Biodiversity Institute

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Table 1: Medicinal plant uses

Scientific and family name	Local name	Voucher number	Plant part	Preparation	Medicinal uses	UR	FC	RFC
Abrus precatorius L. **Fabaceae**	Matihloya baloyi	Mophutin g 119334	Whole plant	Decoction	Kidney problems Blood in urine	2	6	0.40
Abutilon fruiticosum **Malvaceae**		Mophutin g 119365	Roots	Decoction	Cramps Muscle pulls	2	7	0.50
Acacia nigrescens **Fabaceae**	Nkaya	Mophutin g 117176	Stem	Infusion	Diarrhoea	1	11	0.70
Acacia nilotica **Fabaceae**	Mugamazu	Mophutin g 117174	Roots	Decoction	Mental illnesses Headaches Wounds	3	10	0.70
Acacia karoo **Fabaceae**	Rizaza	Mophutin g 119360	Roots	Decoction	Sexually transmitted infections	3	8	0.50
Albizia harveyi **Fabaceae**	Ndzololwane	Mophutin g 117161	Roots	Decoction	Rituals Cleansing ceremony	1	7	0.47
Alectra sessiliflora **Scrophulariaceae**	Ndluwa	Mophutin g 119340	Roots Whole plant	Decoction	Kidney problems	1	6	0.40
Agathisanthemum bojeri **Rubiaceae**	Mavunge	Mophutin g 119330	Roots	Decoction	Swollen testicles	1	4	0.27
Aloe marlothii **Liliaceae**	Mhangana	Mophutin g 117180	Stem	Burn	Eyes High blood pressure	2	15	1.00
Antidesma venosum **Euphorbiaceae**	Ntsongwe	Mophutin g 117167	Roots	Decoction	Fertility in women	2	10	0.67
Asparagus sp. **Asparagaceae**	Nkwangula-tilo	Mophutin g 119329	Whole plant	Decoction	Sores Itching skin	2	8	0.53
Asparagus exuvialis **Asparagaceae**	Nkwangulatil o lowuntsongo	Mophutin g 119347	Roots	Decoction	Back pains Fatigue	2	9	0.60
Boophone disticha **Amaryllidaceae**	Rihemana	BC54	Bulb	Decoction	Truth serum Bad luck	2	10	0.67
Carissa edulis **Apocynaceae**	Xivambula/nu m-num	Mophutin g 119351	Roots	Infusion	Vomiting blood Ear problems	2	12	0.80
Catunaregam sp. A **Poaceae**	Xirhombe	Mophutin g 119345	Fruit	Infusion	Induces vomiting Laxative	2	13	0.87
Catunaregam spp. **Rubiaceae**	Xirhuki	Mophutin g 117170	Fruits	Fruit	Induces vomiting Traditional healer training	1	7	0.47
Chamaecrista capensis **Fabaceae**	Mahlakule	Mophutin g 119343	Roots	Decoction	Witchcraft	2	15	1.00
Crotalaria agatiflora **Fabaceae**	Mahlampyana	Mophutin g 119344	Roots	Infusion	Laxative	1	5	0.33
Cordia ovalis **Boraginaceae**	Mpungwana Xinyanyam	Mophutin g 117159	Bark of the stem	infusion	Good luck	1	14	0.93
Combretum imberbe **Combretaceae**	Mondzo	Mophutin g 117175	Roots or stem	Infusion	Menstruation	1	10	0.67
Combretum collinum **Combretaceae**	Fufu	Mophutin g 117156	Roots	Infusion	Painful legs Cramps Joint pains	4	10	0.67
Combretum apiculatum **Combretaceae**	Xihlalavhana	Mophutin g 119358	Whole plant	Decoction	Mouth colouring	1	3	0.20
Crabbea hirsuta **Acanthaceae**	Xitsayitsayi	Mophutin g 119366	Roots	Infusion	Eye problems	1	8	0.53
Crotolaria cf. burkeana	Phuphuma	Mophutin g 117184	Roots	Mix with lotion	Love charm Good luck	2	10	0.67

Fabaceae								
Cucumis sp. **Cucurbitaceae**	Mluma nyama	Mophutin g 119363	Roots	Decoction	Menstrual pains	1	8	0.53
Dalbergia melanoxylon **Fabaceae**	Xiphaladzi	Mophutin g 117154	Roots	Decoction Infusion	Rashes	1	13	0.87
Dicerocaryum eriocarpum **Pedaliaceae**	Dinda	Mophutin g 119332	Whole plant	Burn	Cow delivery Headaches	2	6	0.40
Dichrostrachys cinerea spp. Nyassana() **Fabaceae**	Ndzenga	Mophutin g 117157	Roots Pods	Decoction Infusion	Snake bite Wounds	2	14	0.93
Diospyros lycioides subs. Lycioides **Ebenaceae**	Xintomane	Mophutin g 119336	Roots	Decoction	STD's	1	3	0.20
Diospyros mespiliformis **Ebenaceae**	Ntoma	Mophutin g 117182	Roots or Leaves	Decoction Infusion	Urinary and sexually transmitted infections	2	10	0.67
Drimea sp. **Hyacinthaceae**	Makatsana	BC62	Bulb	Decoction	Treats tapeworms	1	7	0.47
Elaeodendron transvaalense **Celastraceae**	Ngwavuma	Mophutin g 117181	Stem	Decoction	Induces vomiting and good luck	2	14	0.93
Euclea crispa **Ebenaceae**	Nhlangula lowu tsongo	BC02	Roots	Chew	Used as toothbrush	1	11	0.73
Euclea natalensis **Ebenaceae**	Nhlangula lowu kulu	BC01	Roots Stem	Chew	Toothbrush Skin care STI	3	11	0.73
Faurea saligna **Proteaceae**	Scima mlilo	118700	Leaves	Decoction	Epilepsy	1	6	0.40
Ficus burkei **Moraceace**	Nhlulabambe	BC89	Roots	Infusion	Eye problems	1	10	0.67
Gazania krebsiana **Asteraceae**	Rhuketela	Mophutin g 119369	Roots	Direct	Head sores	1	8	0.53
Gladiollis sp. **Iridaceae**	Byanyi-byanhova	Mophutin g 119353	Bulb	Infusion	Induces vomiting	1	5	0.33
Grewia occidentalis **Malvaceae**	Nsihana	Mophutin g 117158	Stem	Direct	Magical	1	12	0.80
Gymnosporia buxifolia **Celestraceae**	Xihlangwe	Mophutin g 117155	Leaves Roots	Decoction Infusion	Epilepsy	1	14	0.93
Gymnosporia buxifolia **Celastraceae**	Rigumkela	Mophutin g 119357	Leaves Roots	Infusion	Epilepsy Fire burns	2	8	0.53
Helichrysum pallidum Asteraceae	Mpetso	Mophutin g 119348	Roots	Burn	Penile sores	1	9	0.60
Hermania sp. **Starculiaceae**	Mbhune	Mophutin g 119333	Roots	Direct	Treats moles	2	6	0.40
Hypoxis hemerocellidea **Hypoxidaceae**	Mbhumbhunu nu	BC42	Bulb	Decoction	High blood pressure	1	15	1.00
Indigofera sp. **Fabaceae**	Khuvana	Mophutin g 119331	Whole plant	Decoction	Magical	2	2	0.10
Ipomoea oblongata **Convolvulaceae**	Dema (Black)	Mophutin g 119362	Bulb	Decoction	Asthma High blood pressure	2	13	0.87
Jasminum L. *abyssinicum* **Oleaceae**	Mthundangazi	Mophutin g 119364	Roots	Decoction	Bladder cleaner	1	11	0.73
Jasminum fluminense **Oleaceae**	Maloyana	Mophutin g 119350	Roots	Decoction	STI	1	6	0.40

Jatropha zeyheri **Euphorbiaceae**	Mfelo	Mophutin g 117173	Bulb	Chew	Miscarriages Testicle sores	3	5	0.33
Kalanchoe thyrsiflora **Crassulaceae**	Xinyanyo	Mophutin g 117166	Whole plant	Mix with lotion	Love charm	1	9	0.60
Laggera crispata **Asteracea**	Xikhwaxa	Mophutin g 119337	Roots	Decoction	Swollen stomach	1	13	0.87
Lannea schweinfurthii var. **stuhl** **Anacardiaceae**	Ximbombokanyi	Mophutin g 119341	Roots	Decoction	Body aches	1	7	0.47
Lippia Javanica **Verbenaceae**	Umsuzwane	Mophutin g 119365	Roots	Decoction	Respiratory problems Chest pains Herbal tea	3	15	1.00
Macrotyloma maranguense **Fabaceae**	Xikondlo	Mophutin g 117171	Bulb	Chew	Swollen or painful testicles	1	7	0.47
Mundulea sericea **Fabaceae**	Vatanyayini	Mophutin g 119368	Roots	Add to bath water	Relieves nervous tension	1	15	1.00
Ochna natalitia) **Ochnaceae**	Mahlanganisi lama kulu	Mophutin g 118701	Roots	Decoction	Painful joints	1	13	0.87
Ormocarpum trichocarpum **Fabaceae**	Xisitane	Mophutin g 117168	Inner bark of roots	Infusion	Erectile dysfunction	2	15	1.00
Opuntia ficus-indica **Cactaceae**	Xitokorofiya	Mophutin g 117178	Stem	Decoction	High blood pressure	1	7	0.47
Ozoroa sphaerocarpa **Anarcadiaceae**	Xinungu mafi	Mophutin g 119359	Whole plant	Decoction Infusion	Induces lactation Wounds	2	11	0.73
Pappea capensis **Sapindaceae**	Xinungu	Mophutin g 118702	Bark	Decoction	Penis enlargement Reduction of breasts in men	3	4	0.27
Pavetta cf. *gracilifolia* **Rubiaceae**	Ncolovoti	Mophutin g 119349	Roots	Decoction	Painful feet	1	6	0.40
Pterocarpus angolensis Fabaceae	Mrhotso	Mophutin g 117169	Roots	Decoction	Heartburn Stomach problems Induces vomiting	2	7	0.47
Pterocarpus rotundifolius **Fabaceae**	Nxelele	Mophutin g 117164	Roots	Grind and add to the kraal water	Fertility in cows	1	13	0.87
Peltophorum africanum **Rosaceae**	Nhlanhlanhu	BC40	Roots	Decoction	Body pain	1	15	1.00
Piliostigma thonningii **Fabaceae**	Nkholonkhotlho	Mophutin g 117183	Roots and leaves	Decoction	Bone aches Erection enhancer	2	15	1.00
Philenoptera violacea **Fabaceae**	Mbhandzu/Apple leaf	Mophutin g 119335	Roots	Infusion	Induces vomiting Good luck	2	9	0.60
Phyllanthus reticulatus **Euphorbiaceae**	Xincimba, Potato bush	Mophutin g 118705	Roots	Decoction	Blood problems	1	7	0.47
Rhoicissus tridentata **Vitaceae**	Mbhezane leyi kulu	Mophutin g 119338	Roots	Decoction	STI	1	6	0.40
Raphionacme procumbens **Asclepiadaceae**	Dema	Mophutin g 117172	Bulb	Mix with milk	Painful waist Enhances erection	2	4	0.27
Senna italica spp. Avachoides **Fabaceae**	N`warimangana	Mophutin g 117179	Roots	Decoction	STI	1	15	1.00
Schontia branchypetala **Fabaceae**	Mvhomvhomvho	Mophutin g 119370	Roots Seeds	Decoction	Shoulder pains Sternum pains	2	4	0.27
Sida Rhombifolia	Tihoveta	Mophutin	Whole plant	Grind and	Anti-dandruff	1	6	0.40

Malvaceae	vhalungu	g 119355		add to bath water				
Solanum tomentosum ***Solanaceae***	Nthomane	Mophutin g 117177	Roots	Infusion	Eyes	1	15	1.00
Sphedamnocarpus pruriens(	Nqhayiye	Mophutin g 119342	Roots	Bath	Pubic lice	1	6	0.40
Sphedomnocarpus pruriens **Malpighiaceae**	Khodaxu	Mophutin g 118703	Roots	Decoction	Vomiting blood	1	11	0.73
Strychnos madagascariensis **Loganiaceae**	Nkwakwa	Mophutin g 117163	Roots	Decoction Infusion	Induces vomiting Magical	2	15	1.00
Terminalia sericea **Combretaceae**	Nkonolo	Mophutin g 118704	Tumors	Decoction	Tonsils	1	15	1.00
Trichilia emetica **Meliaceae**	Nkuhlu/Natal mahogany	Mophutin g 119354	Roots Stem	Infusion	Painful feet Body cleaner	2	15	1.00
Vernonia colorata **Compositae**	Mpyila	Mophutin g 117160	Roots	Decoction	Foot problems topically	2	11	0.73
Cf. *Vernonia* **Asteraceae**	Rikhwekhwe	Mophutin g 119352	Whole plant	Mix with lotion	Body wounds	1	2	0.10
Vangueria infausta **Rubiaceae**	Xinyathelo	Mophutin g 117162	Roots	Decoction	Snake repellent, Snake bites	2	9	0.60
Ziziphus mucronata **Rhamnaceae**	Mpasamhala	Mophutin g 117165	Leaves Roots	Mix with lotion	Skin problems	2	14	0.93
To be identified	Masunungulu	Mophutin g 119361	Roots	Chew	Stomach disorders Tapeworms	2	7	0.47
To be identified	Mphovhane	BC32	Roots	Decoction	Wounds	1	8	0.27
To be identified	Mhlambululo wangati	Mophutin g 119339	Roots	Decoction Bath	Swollen body Body pains	2	15	1.20
To be identified	Mpempenya	BC89	Roots	Decoction	STI	2	9	0.60

(Van Wyk and Malan, 1997: van Wyk et al., 2005; Van Wyk, 2009; van Wyk et al., 2009)

(SANBI) for comparison and verification of scientific names. Each plant species (herbarium specimen) was assigned with a unique voucher specimen number.

Data analysis

The data were entered into Microsoft Excel sheets for analysis and identifying various proportions, such as plant parts used, plant families and the number of plants used per ailment category. Various qualitative indices, including the informant consensus (ICF), use report (UR), and relative frequency of citation (RFC), were applied. The informant consensus factor (ICF) for different ailment categories was calculated with the following formula, as cited in the literature (Yaseen et al., 2015 and Teklehaymanot, 2009: ICF =N_{ur} – T/ N_{ur} – 1, where N_{ur}= number of instances of use reported in a particular ailment category and T = number of plant species used to treat that particular category by informants.

The informant consensus has been abbreviated as FCI in other articles (Cheikhyoussef et al., 2011; Singh et al., 2012; Belayneh et al., 2012). The use report (UR) is the use recorded for every species (Yaseen et al., 2015). The Frequency citation (FC) is the number of informants reporting the use of the species and the relative frequency (RFC) was calculated using the following formula: RFC=FC/N, This index is obtained by dividing the FC (number of informants reporting the use of the species) by the total number of informers contributed in the survey (N), without bearing in mind the use categories (Yaseen et al., 2015).

Results and discussion

The ages of respondents (Traditional healers) interviewed ranged from 40 to 90 years old and majority of them were female (82%). During the survey, a total of 82 plant species covering 77 genera and 42 families were recorded, collected and identified. Table 1 presents the ethnobotanical inventory with detailed information (local names, family names, parts used, preparation method, medicinal uses, and use report, frequency citation (FC) and relative frequency citation (RFC). The highest use report was reported for *Combretum collinum* (4), while the FC and RFC values (15) were highest in 12 plants.

The results of this study showed that most plants documented are used in the ailment category of urino-genital disorder (25 species), followed by gastro-intestinal disorders, skeleto-muscular pain and swelling (eight species), other ailments (eight species) and ear, eye and oral problems (six species). Dermatological disorders, cosmetics, high blood pressure and respiratory diseases all had four plant species each. Moreover, a single plant is used for more than one ailment, for example, *Acacia nilotica* (mental illnesses, headaches, and wounds), *Ipomoea oblongata* (asthma and high blood pressure), and *Lippia javanica* (chest pains and herbal tea).

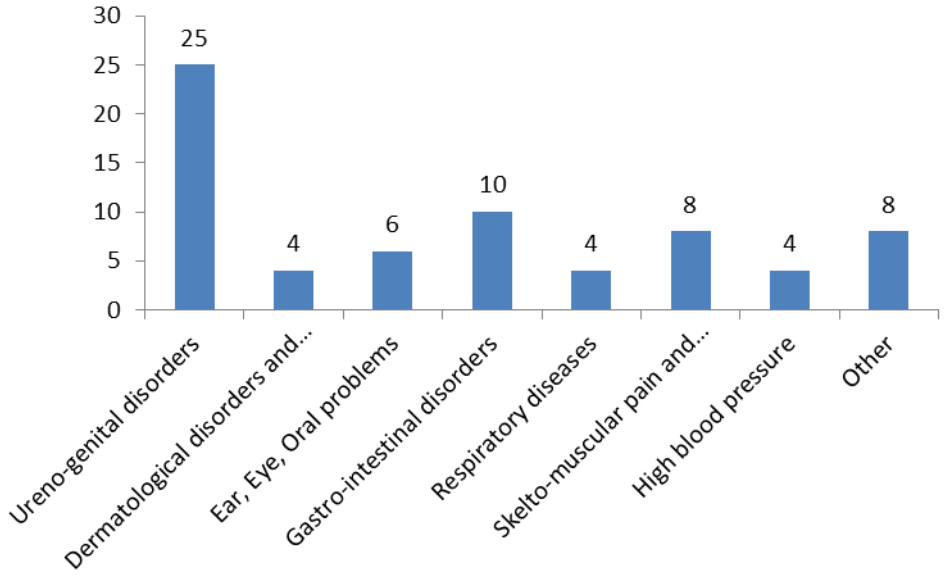

Figure 2: Number of plant species used per ailment category

The most frequently represented families were Fabaceae (19 species), followed by Combretaceae, Ebeneceae, and Asteraceae (three species each). The rest of the families were represented by either one or two species each. The family fabaceae is characterized by a large number of traits. Most of the taxa of this family are herbaceous, sometimes shrubby and are very rarely trees. This family is also characterized by an impressive phytochemical diversity. Flavonoids and tannins are the most common polyphenols found in the family, but for a pharmaceutical perspective the various types of alkaloids found are the most interesting and pharmaceutically relevant (Van Wyk & Van Wyk, 1997; Heinrich *et al.*, 2004). The reported medicinal plants are used in the treatment of various ailments categorised in Table 2, which also shows the informant consensus factor. In recent ethnobotanical studies, consensus analysis has been used in order to measure the reliability of the data given by different informants (Tabuti et al., 2012; Kumar et al., 2012; Garcia et al., 2010).

The highest ICF value (1) was recorded for respiratory diseases category. The other ailment categories ICF ranges from 0.50 to 0.84, with an average value of 0.79. Plant species are used by the local inhabitants for the treatment of various ailments. These ailments were grouped into eight categories based on indigenous classifications developed by medical practitioners. However medicinal uses such as rituals, love charm, witchcraft, and mental disorders did not match with the classes of broad diseases and these were placed in a separate category (other).

Table 2: Number of plants used for different ailment categories

Ailment categories	Biomedical terms	ICF or F_{ci}
Urino-genital disorders	Kidneys, sexually transmitted diseases, infertility, menstrual disorders, erectile dysfunction	0.84
Dermatological disorders and cosmetics	Skin problems, wounds, burns, anti-dandruff	0.75
Ear, eye, oral problems	Ear, eye and oral problems	0.84
Gastro-intestinal disorders	Vomiting, stomach ache, diarrhoea, laxatives and worms	0.78
Respiratory diseases	Chest pains, asthma,	1.00
Skeleto-muscular pain and swelling	Body aches, muscular pains, headache, joint pains, swelling	0.86
High blood pressure		0.76
Other	Rituals, love charm, witchcraft, mental disorders	0.50

F_{ci} = Factor of informants consensus

This study found that different parts (roots, leaves, seeds, fruit, etc.) of medicinal plants are used by traditional healers to prepare herbal remedies. Figure 3 shows that, among these plant parts used, roots (56%) are the most frequently used, followed by stems (9%), whole plants (9), fruits (4%) and other (3%). Similarly, in studies conducted in many other African countries, roots were indicated to be the most used plant part and Infusion and decoction are the most common preparation methods that are used by traditional healers with water often used as a solvent system (Ahmad et al., 2014,).

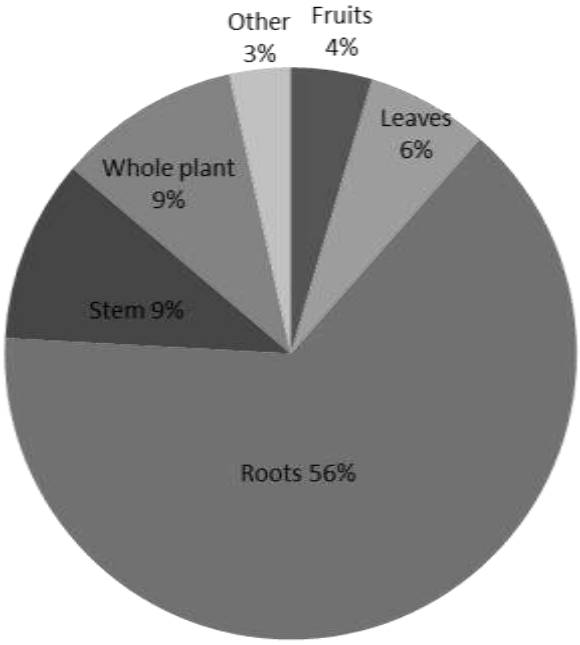

Figure 3: Plant part used as medicine

It is therefore, important to save the traditional knowledge through conservation and scientific investigations of plant species collected. In this context, more detailed studies about the use of medicinal plants by the Jongilanga communities are currently carried out by our research group, and the biological activities of the plant species used in the treatment of ureno-genital disorders are being evaluated.

Conclusion

Our ethno-botanical survey documents an important ethnobotanical knowledge on the medicinal plants that are widely been used by Shangaan people in villages under the Jongilanga tribal council. Forty-two families consisting of 82 species were found to be used for medicinal purposes in these communities. These plants treated conditions such as malaria, tuberculosis, and sexually transmitted diseases. Roots are the mostly harvested plant part; however there is a need to educate traditional healers about the danger of over-exploitation of these medicinal plants for future use.

Among the plant species reported, some could be of real potential to improve human life if studied further. Screenings in various bioassays of selected plants from this study are under way in order to ascertain their biological effectiveness and toxicity. Majority of the medicinal plants recorded in this study have a least concern status according to South African National Biodiversity Institute (SANBI) red list of 2015. Cultural conservation practices are still in place in these communities, however there is still a need to educate community members about sustainable use of plants. Future research on ecological and cultural conservation efforts are needed for the sustainable use of medicinal plants.

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