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Original Article

Phytotherapy for Sexually Transmitted Infections In Thaba 'Nchu, Free State Province, South Africa

Brian Ngobeni[1,4], Idah Tichaidza Manduna[2,*], Ntsoaki Joyce Malebo[3], Samson Sitheni Mashele[1]

ABSTRACT

Medicinal plants have been prescribed by traditional healers for the treatment of Sexually Transmitted Infections STIs for years. This study documents therapeutic plants used against STIs in Thaba 'Nchu, South Africa. Information was gathered through semi-structured interviews with traditional medical practitioners between March and December 2017. Information on medicinal plants, their local names, and their uses against STIs was gathered. The use value (UV) of the plant species, frequency of citation (FC) and the informant consensus factor (ICF) were calculated for the plants and STIs included in the study. Plants were used to treat infections such Herpes zoster (ICF=0.4) as gonorrhoea (ICF=0.11), vaginosis (ICF=0.2), symptoms of HIV/AIDS (ICF=0.1) and pubic lice (ICF=0.1). A total of 35 plant species were identified for the treatment of STIs. Most medicinal plants in the study area came from the families Asteraceae (21%), Fabaceae (17%), Solanaceae (13%) and Hyacinthaceae (13%). *Bulbine narcissifolia, Pentanisia prunelloides, Hypoxis hemerocallidea, Scabiosa columbaria, Xysmalobium undulatum Rumex lanceolatus, Eucomis autumnalis, Dicoma anomala* and *Salvia runcinata* were frequently used. The preferred method for preparation of remedies were decoctions made from the roots (72%), whole plant (17%), leaves (7%), fruits (2%) and bark (2%) which were consumed orally.This study contributes to the documentation of plants used for STIs to conserve the information for future generations. A selection from the most frequently mentioned plants for treatment of STIs may be used for further phytopharmacological investigations and subsequently be used for the development of new antimicrobial agents for global use and for the socioeconomic development of local communities.

Key words: Ethnobotany, Medicinal plants, Sexual transmitted infections, Thaba 'Nchu, Traditional Healers.

Brian Ngobeni[1,4], Idah Tichaidza Manduna[2,*], Ntsoaki Joyce Malebo[3], Samson Sitheni Mashele[1]

[1]*Department of Health Sciences, Central University of Technology, Free State, Private Bag X20539, 9300, SOUTH AFRICA.*

[2]*Centre for Applied Food Sustainability and Biotechnology, Central University of Technology, Free State, Private Bag X20539, 9300, SOUTH AFRICA.*

[3]*Department of Life Sciences, Central University of Technology, Free State, Private Bag X20539, 9300, SOUTH AFRICA.*

[4]*Department of clinical Sciences, Central University of Technology, Free State, Private Bag X20539, 9300, SOUTH AFRICA.*

Correspondence

Idah Tichaidza Manduna

Centre for Applied Food Sustainability and Biotechnology, Central University of Technology, Free State, Private Bag X20539, 9300, SOUTH AFRICA.

E-mail: imanduna@cut.ac.za

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INTRODUCTION

The World Health Organization reported an estimated 357.9 million cases of sexually transmitted infections STIs that occur annually worldwide. South Africa has high rates (7.9 million in 2017) of HIV infections and millions of residents are co-infected with other STIs.The burden of these sexually transmitted infections is a global cause for concern because of the negative health, economic and social implications.[1-3] Addressing the burden of STIs requires concerted efforts from multiple angles including traditional knowledge and medicinal plants.

STIs are usually transferred from one person to the other through sexual contact. The most common pathogens responsible for STIs are *Treponema pallidum*, *Neisseria gonorrhoeae*, *Chlamydia trachomatis* and *Trichomonas vaginalis,*[4,5] which are treated with antimicrobial agents such as penicillin, azithromycin, amoxycillin,quinolone ciprofloxacin, metronidazole, famciclovir and many other drugs.[6] However, most patients in developing countries especially from rural areas fail to seek therapy from official health care centres therefore they turn to traditional healers for help.[7] Traditional healers are usually the first caregivers in rural areas because of traditional beliefs, poverty, and patient stigmatization.[7,8] Additionally, limited accessibility to health care facilities, long waiting queues, lack of laboratories, shortages of drugs and poor attitudes of health workers make traditional medicine more appealing.[9-11]

Traditional medicine especially medicinal plants, play an important role in the treatment and management of human diseases and ailmentsin South Africa.[12] Plants are the greatest source of remedies for many health problems as about 71 % of new drugs that have been approved since 1981 have directly or indirectly been derived from natural products.[13] The need for basic scientific investigations on medicinal plants using indigenous knowledge has become more relevant because they can lead to discovery of novel compounds that will contribute to development of new drugs.[14] However, some traditional communities have become less concerned about local resources and have adopted modern lifestyles, resulting in the loss of indigenous plant knowledge.[15] Urbanization, modernization of public services including education systems, and globalization of trade and belief systems, and the rapid loss of natural habitats also contributes to the loss of knowledge.[16] Furthermore, ethnobotanical knowledge of plant uses is typically passed down across generations through oral tradition which can lead to distortion.[17-19] As a result, documenting traditional medicinal plant applications has become essential and critical.

Information on medicinal plant use in the Free State Province of South Africa is readily available in literature[20-28] however; none is focused on the treatment of STIs in this particular region. Similar studies in South Africa have been carried out in other provinces for example, ethnic groups like Bapedi and Vhavenda in Limpopo,[29-34] Zulu people in Kwa-Zulu Natal province,[35,36] Tsonga people in

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Mpumalanga province,[37] Xhosa people in the Eastern and Western Cape province.[38-40] Similarly, other studies have documented plants used by Basotho for treatment of various diseases in the Free State and Lesotho.[41-45] Therefore, the aim of this study is to document the medicinal plants used for treatment of STIs in Thaba 'Nchu located in the Free State province of South Africa. STIs were the most treated by traditional healers in this area.

Study area

Thaba 'Nchu is dominated by BaSotho and BaTswana who represent 80% of the overall population of the area. People in the area make a living through informal trade, agriculture, and some find employment in nearest city Bloemfontein.[46] It is one of the emerging towns of the Free State that has yet to be studied in terms of ethnobotany. Thaba 'Nchu is in the central portion of the Free State province, covering an area of roughly 704 km^2, and is about 67 km east of Bloemfontein (29.2040° S and 26.8204° E) (Figure 1). The study area is in the grassland biome, where the dominant plants are grasses, geophytes, and other small flowering plants. Thaba 'Nchu receives about 435 mm of rain annually, with most rainfall occurring mostly during the summer. It receives the lowest rainfall (3mm) in June and the highest (73mm) in March. The average midday temperatures range from 15.4°C in June to 28.5°C in January. The region is the coldest during July where temperatures drop to 0.1°C on average during the night.[47]

METHODS

Data collection

The protocol for this study was approved by the University Research and Innovation Committee (URIC) of the Central University of Technology, Free State and all ethical considerations associated with research in traditional/indigenous communities were observed. The traditional practitioners in the survey were identified and selected based on their willingness to participate using purposive sampling through a traditional healer's association found in the area. Before commencement, the study was explained by the researcher to the members of the association in the local Sesotho language. Thereafter, semi-structured interviews were conducted after obtaining informed consent from willing participants between March and December 2017. Prior to the main individual interviews, a focus group with traditional healers was held to test the reliability and validity of the questions. Twenty-four traditional healers were individually interviewed for information about medicinal plants used to treat STIs in the Thaba 'Nchu. The data included the local names of the plants, the parts used, the mode of preparation, route of administration and the diseases treated. Plant specimens were collected with guidance from the traditional healers from the surrounding grasslands and from some home gardens. Plants were identified first by their vernacular names and later taken to SANBI (South African National Biodiversity Institute)

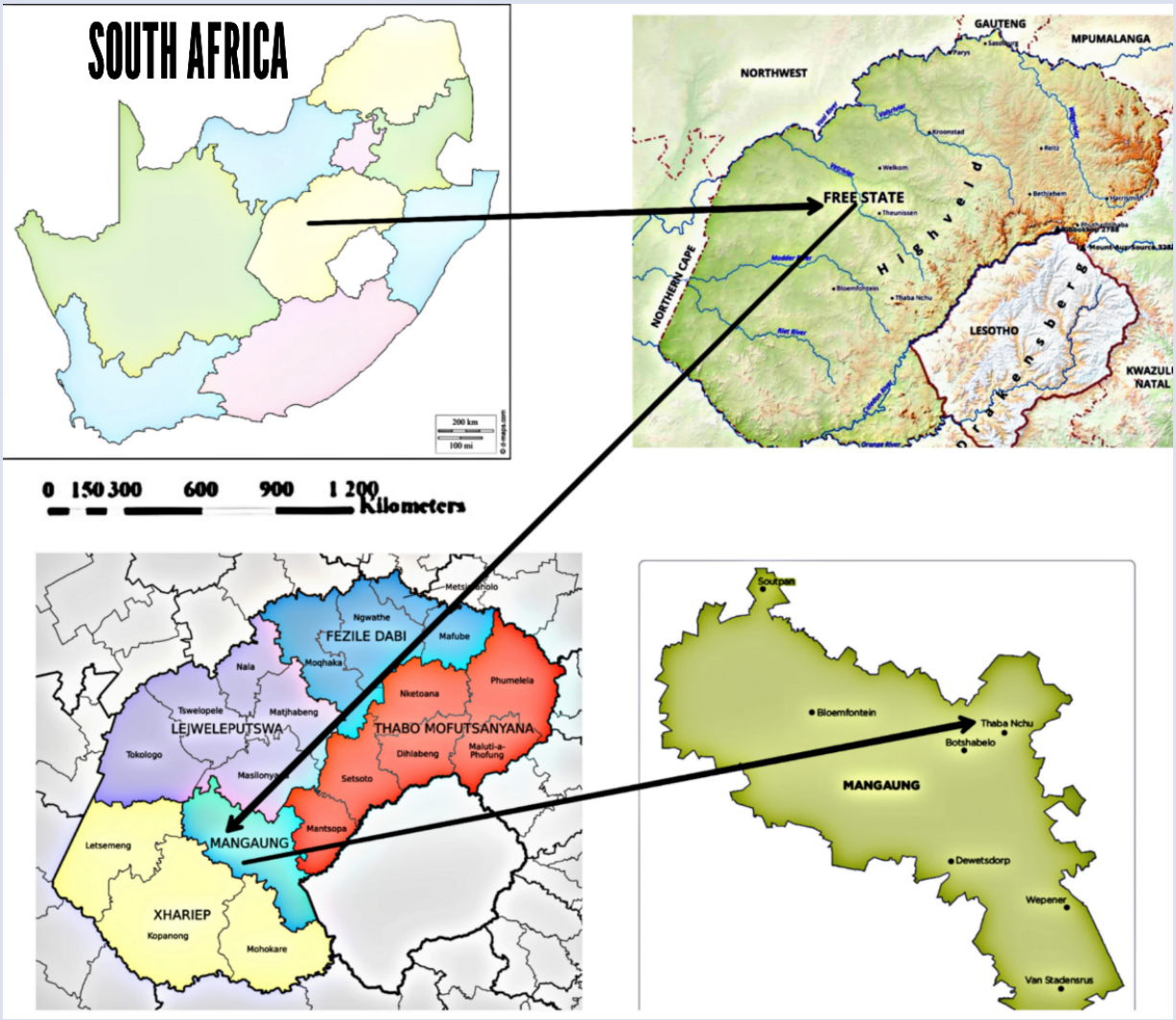

Figure 1: Geographical location of the study area.

in Bloemfontein for validation. Voucher specimens were deposited in Centre of Applied and food Sustainability and Biotechnology (CAFSaB), Central University of Technology.

Data analysis

Following the interviews, the local importance of each plant species reported by traditional healers in the study area for treating STIs was calculated using the Informant Consensus Factor (ICF) and the Use value (UV).

Informant consensus factor

The consensus of informants within a community and between cultural groups discloses which plants are important and regularly used. This is relevant for conservation purposes and aids in plant selection for pharmacological and phytochemical research.[48] ICF was used to identify plants with cultural significance as well as consensus on how to use plants. The Informant Consensus factor was calculated using the formula:

ICF=Nur - Nt / Nur - 1

Where:

Nur = the number of use citations in each disease category.

Nt = the number of species used in each disease category.

The ICF is used to ensure that the information obtained is homogeneous. A high value (near #1) indicates that a specific plant species is used by the majority of informants interviewed for treating a disease category, whereas a low value (0 or close to 0) indicates that each informant used a different plant species and expresses disagreement among informants regarding the treatment of that disease category by a specific plant species.[49]

Frequency of citation (FC)

FC was used to evaluate the most preferred plants or more used plant species for treatment of STIs. The FC of the species of plants being utilized was evaluated using the following formula:[37]

For diseases treated:

$$FC = \frac{\text{Number of times a particular disease was mentioned}}{\text{Total number of times that all the diseases were mentioned}} \times 100$$

For plant species used:

$$FC = \frac{\text{Number of times a particular species was mentioned}}{\text{Total number of times that all species were mentioned}} \times 100$$

Use value (UV)

The Use Value is a quantitative method that describes the importance of a plant based on its frequency of mention by respondents and was calculated according to the following formula:[50]

UV=U/N

Where:

UV = is the use value of a species.

U = to the number of citations per species.

N = to the number of informants.

A high UV score for a plant indicates that there are many usage reports for that plant, which may also be considered an important plant in the community, whereas a low score indicates that informants reported less usage reports for that plant.

RESULTS AND DISCUSSION

The participants

An ethnobotanical survey was conducted to document plants used for STI's by traditional healers of Thaba 'Nchu. The results of the study showed that the overall age of the participants ranged between 20 and 80 years. More females (79.2%) than males (20.8%) participated in the study (Table 1). This kind of female dominance is contrary to findings in Lesotho[28] where most of the traditional healers were men because of the belief that women should manage home duties such as taking care of the families, including children and the elderly. In this study, there were more women, which conforms to the general setup of a community dominated by female-headed households in the Free State province.[51] They practice traditional healing to earn an income and provide for their families. Additionally, men from the community usually find work in places that are far away from Thaba 'Nchu, therefore they no longer participate in traditional healing in the area. The trends that were observed in this study also adhere to the Age, Gender, and Dynamics of Knowledge Hypotheses,[52,53] which states that women and older people tend to have more knowledge of local medicinal plants. Most traditional healers who participated in the study were between the ages of 40-59, accounting for 45% of all participants, with the remainder being either young or old (Table 1). Most traditional healers had a traditional calling to practice traditional healing while some used it as their primary source of income to support their families due to unemployment.

STIs commonly treated using medicinal plants in the study area

The participants in Thaba 'Nchu commonly treated STIs such as gonorrhoea, herpes zoster, HIV, pubic lice, and vaginosis. However, some traditional healers did not differentiate STIs and generally used the term *"Mafu a thobalano"* to refer to any diseases that affect the reproductive organs obtained from having sex. According to the frequency of mention (Figure 2) and frequency of citation (Table 2), herpes zoster, followed by gonorrhoea and vaginosis were the most treated STIs in the study area. The ICF ranged from 0.4 to 0 for all the disease categories treated in the community. This showed weak consensus (heterogeneity) in across all the reported diseases and indicates that multiple plant resources are used to treat the same STI.

Table 1: Demographic characteristics of individual participants (n=24).

Age (years)	Female	Male	Number	Percentage (%)
20-29	2	1	3	12.5
30-39	3	1	4	16.7
40-49	4	1	5	20.8
50-59	6	0	6	25.0
60-69	1	1	2	8.3
70+	3	1	4	16.7
Total	**19**	**5**	**24**	**100**

Table 2: Frequency citations and ICF values of the STIs treated using medicinal plants in Thaba 'Nchu.

STIs	Local name	FC (%)	ICF
Vaginosis	'Seso'	19.23	0.2
HIV/AIDS	'Phamokate'	7.7	0.1
Herpes zoster	'Lebanta'	30.8	0.4
Pubic lice	'Dintatsasenana'	7.7	0.1
Gonorrhoea	'Lerothodi'	22.1	0.11
Unspecified STIs	'Mafu a thobalano'	11.5	0

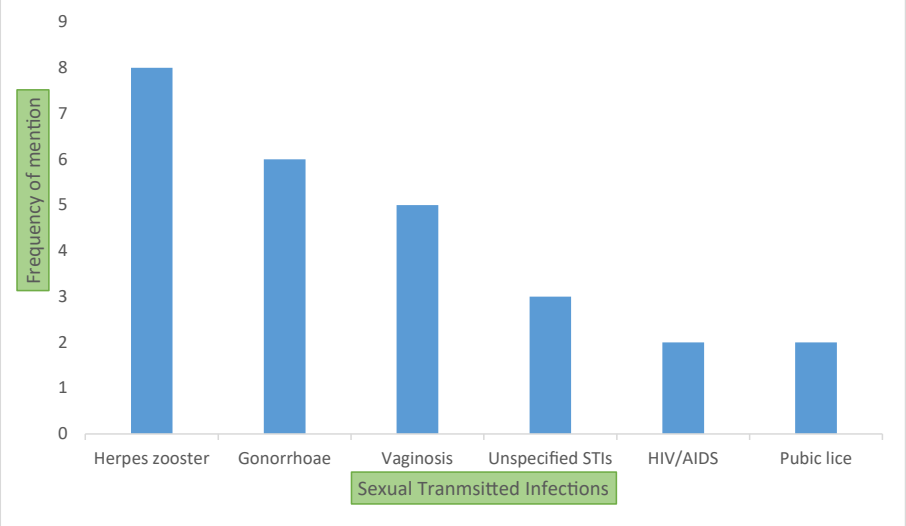

Figure 2: Frequency of mention of STIs treated with medicinal plants.

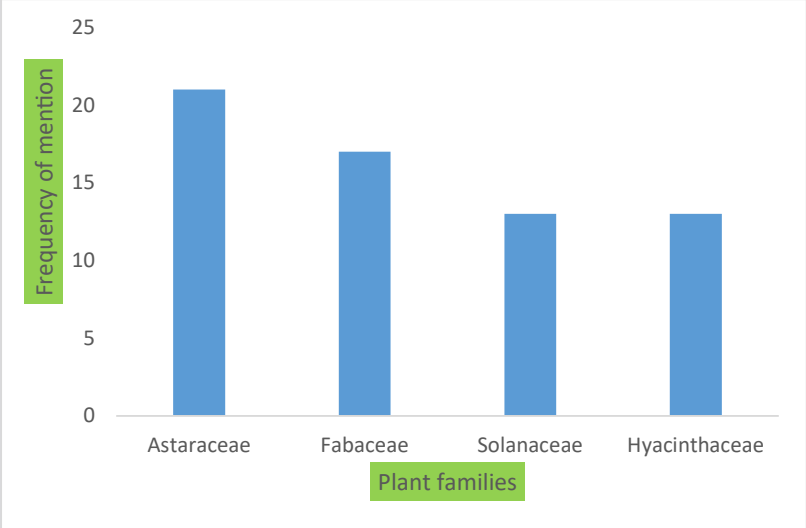

Figure 3: The most cited plant families in area of study in percentages.

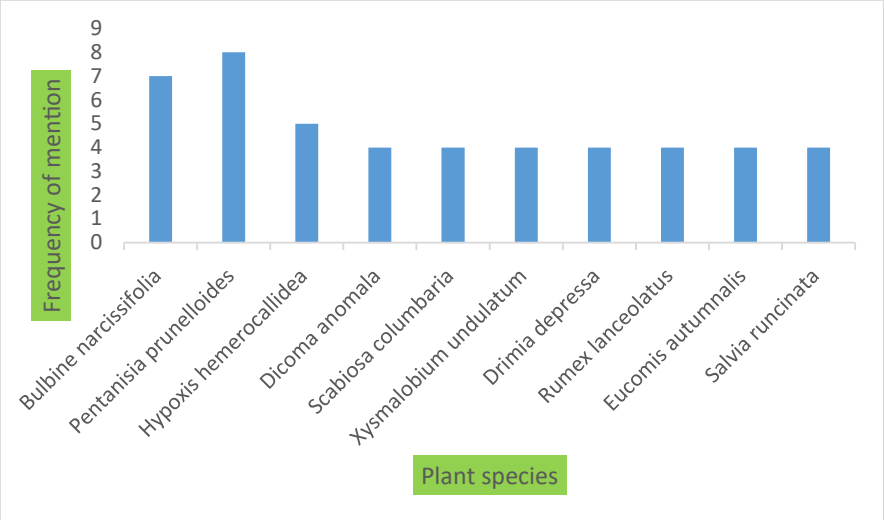

Figure 4: The most cited plants by informants in the study area.

Table 3: Medicinal plants used to treat STIs in Thaba 'Nchu.

Scientific name	Local name	Family	Voucher specimen number	Plant parts	STIs treated	Companion Plants	Method of preparation and route of administration.	UV	FC (%)
Bulbine narcissifolia Salm-Dyck	Khomo-ea-balisa	Asphodelaceae	B001	Leaves Flowers	Gonorrhoea Vaginosis	*Rumex lanceolatus,Leucosidea sericea,Metalasia muricata, Gunneraperpensa, Eucomisautumnalis*	Decoction (Orally)	0.29	8.3
Euclea coriace A.DC	Monna-mots'o	Ebenaceae	B002	Roots	Gonorrhoea	*Hypoxishemerocallidea*	Decoction (Orally)	0.04	1.19
Pentanisia prunelloides (Klotzsch ex Eckl. &Zeyh.) Walp.	Setima-mollo	Rubiaceae	B003	Whole plant	Herpes zoster Gonorrhoea	Pentanisia*prunelloidesXysmalobiumundulatum*, *Dicomaanomala, Turbina oblongata, Metalasia muricata, Salvia runcinata*and *Nasturtium officinale.* *Bulbinenarcissifolia* *Bulbinenarcissifolia,* Solanum*aculeatissimum*, *Berkheyamontana* and *HypoxisHemerocallidea.* *Bulbinenarcissifolia ,HypoxisHemerocallidea*	Decoction (Orally) Plant powder (Topically) Decoction Bath	0.33	9.52
Dicoma anomala Sond. subsp. cirsioides (Harv.)	Hloenya	Asteraceae	B004	Roots	HIV/AIDS	*Xysmalobiumundulatum*, *Nasturtium officinale*, Cussonia*paniculata*	Decoction (Orally)	0.17	4.76
Scabiosa columbaria L.	Selomi	Dipsacaceae	B005	Whole plant Roots	Gonorrhoea Unspecified STIs	*Xysmalobiumundulatum* and *Hermaniadepressa.* Scabiosa columbaria, *HermaniadepressaHelichrysum caespititium*	Decoction (Orally) Decoction (Orally)	0.17	4.76
Asparagus microraphis(Kunth) Baker	Lereratau	Asparagaceae	B006	Roots	HIV	*Scabiosa columbaria* and *Agave Americana*	Decoction (Orally)	0.04	1.19
*Hermaniadepressa*N.E.Br.	Seletjane	Sterculiaceae	B007	Roots	Gonorrhoea Unspecified STIs	 Scabiosa *columbaria* and *Salvia runcinata.*	Decoction (Orally) Decoction (Orally)	0.08	2.4
Xysmalobiumundulatum (L)	Poho-Ts'ehla	Apocynaceae	B008	Roots	HIV	*Dicomaanomala and Nasturtium officinale.*	Decoction (Orally)	0.17	4.76
Helichrysum caespititium (DC)	Phate-ea-ngaka	Asteraceae	B009	Whole plant	Unspecified STIs	*Scabiosa columbaria* and *Hermaniadepressa.*	Decoction	0.04	1.19
Drimiadepressa(Baker) Jessop	Moretele	Hyacinthaceae	B0010	Roots	Herpes zoster	Vimbela and coarse salt.	Ashes (Topically)	0.17	4.76
Withaniasomnifera(L) Dunal	Mofera-ngope	Solanaceae	B0011	Roots	Gonorrhoea	A decoction is prepared and mixed with the roots of*Xysmalobiumundulatum* for treatment of Gonorrhoea.	Decoction (Orally)	0.08	1.19
*Rumex lanceolatus*Thunb	Khamane	Polygonaceae	B0012	Roots	Gonorrhoea Vaginosis	*Eucalyptus spp* *Lessertiadepressa,Dicomaanomala, Eucomisautumnalis* and *Euphorbia clavarioides.*	Decoction (Orally)	0.17	4.76
Leucosidea sericea Eckl. &Zeyh.	Cheche	Rosaceae	B0013	Leaves	Vaginosis	*Bulbinenarcissifolia, Rumex lanceolatus, Metalasia muricata, Gunneraperpensa, Eucomisautumnalis.*	Decoction (Orally)	0.04	1.19
*Euphorbia clavarioides*Boiss	Sehlooko	Euphorbiaceae	B0014	Roots	Vaginosis	*Lessertiadepressa, Dicomaanomala, Eucomisautumnalis*	Decoction (Orally)	0.04	1.19
Eucomisautumnalis(Mill.)	Khapumpu/ Mathethebale	Hyacinthaceae	B0015	Roots	Vaginosis	*Lessertiadepressa, Dicomaanomala, Euphorbia clavarioides*	Decoction (Orally)	0.17	4.76
Metalasia muricata R.Br.	Tee-ae-baroa	Astaraceae	B0016	Whole plant	Vaginosis	Bulbine*narcissifolia, Rumex lanceolatus, Leucosidea sericea, Gunneraperpensa, Eucomisautumnalis*	Decoction (Orally)	0.04	1.19
*Salvia runcinata*L.f	Mosisili	Lamiaceae	B0017	Roots	Pubic lice	*Rumex lanceolatus, HypoxisHemerocallidea,Eucomisautumnalis, Selaginella caffrorum, Bulbinenarcissifolia, Drimiadepressa.* *Drimiadepressa* and Aloe ferox.	Decoction (Orally) Bath (Topically)	0.17	4.76
*Gunneraperpensa*L.	Qobo	Gunneraceae	B0018	Whole plant	Vaginosis	Bulbine*narcissifolia, Rumex lanceolatus, Leucosidea sericea, Eucomisautumnalis*f	Decoction (Orally)	0.04	1.19
Malva parviflora L.var	Tikamotse	Solanaceae	B0019	Leaves	Herpes zoster		Decoction (Orally)	0.08	2.4
Berkheyamontana(DC)	Mohatollo	Asteraceae	B0020	Roots	Gonorrhoea	*Solanum aculeatissimum, Berkheyamontana, HypoxisHemerocallidea, Bulbinenarcissifolia.*	Decoction (Orally)	0.04	1.19
Achyranthes aspera Linn.	Lemanamana	Fabaceae	B0021	Roots	Pubic lice	*Achyranthes aspera,* 'Madubula' antiseptic	Bath (Topically)	0.04	1.19

*Solanum aculeatissimum*Jacq	Thola	Solanaceae	B0022	Roots	Gonorrhoea	*Solanum aculeatissimum*, *Berkheyamontana*, *HypoxisHemerocallidea*, *Bulbinenarcissifolia*.	Decoction (Orally)	0.08	2.4
Agave americana L. subsp. americana	Lekhala	Agavaceae	B0023	Whole plant	Vaginosis	*Drimiadepressa*, *Eriocephaluspunctalus*, *Salvia runcinata*, *HypoxisHemerocallidea*, *Eucomisautumnalis* .	Decoction (Orally)	0.04	2.4
Eucalyptus spp	Boloukomo	Myrtaceae	B0024	Bark	Gonorrhoea	*Rumex lanceolatus*	Decoction (Orally)	0.04	1.19
*Lessertiadepressa*Harv.	Mmusapelo	Fabaceae	B0025	Roots	Vaginosis	*Dicomaanomala*and *Eucomisautumnalis*, *Euphorbia clavarioides*	Decoction (Orally)	0.04	1.19
Schizocarphusgerrardii(Baker) Van der Merwe	Letjoetlane	Hyacinthaceae	B0026	Roots	Vaginosis	*Bulbinenarcissifolia*	Decoction (Orally)	0.04	1.19
Turbina oblongata A. Meeuse	Mothukho	Convolvulaceae	B0027	Whole plant	Herpes zoster	*Xysmalobiumundulatum* and *Dicomaanomala*, *Pentanisiaprunelloides*, *Metalasia muricata*, *Salvia runcinata*and *Nasturtium officinale*.	Decoction (Orally)	0.04	1.19
Selaginella caffrorum(Milde)	Moriri-oa-matlapa	Selaginenellaceae	B0028	Roots	Pubic lice	*Rumex lanceolatus*, *HypoxisHemerocallidea*,*Eucomisautumnalis*, *Salvia runcinata*, *Bulbinenarcissifolia*, *Drimiadepressa*	Bath (Topically)	0.04	1.19
Elephantorrhiza elephantine (Burch) Skeels	Mositsane	Fabaceae	B0029	Roots	Vaginosis	*Agave americana*, *Drimiadepressa*, *Eriocephaluspunctalus*, *Salvia runcinata*, *HypoxisHemerocallidea*, *Eucomisautumnalis*.	Decoction (Orally)	0.08	2.4
*Eriocephaluspunctalus*DC	Sehalahala-sa-matlaka	Asteraceae	B0030	Roots	Vaginosis	*Agave americana*, *Drimiadepressa*, *Salvia runcinata*, *HypoxisHemerocallidea*, *Eucomisautumnalis*, *Elephantorrhiza elephantine*.	Decoction (Orally)	0.04	1.19
Melolobiummicrophyllum(L.F.)	Mofahlatoeba	Fabaceae	B0031	Whole plant	Unspecified STIs		Decoction (Orally)	0.04	1.19
*Cussoniapaniculata*Eckl. &Zeyh. Subsp. Sinuate	Mots'ets'e	Araliaceae	B0032	Roots	HIV	*Heteromorpha trifoliate*.	Decoction (Orally)	0.08	2.4
Heteromorpha trifoliata (H. L. Wendl.) Eckl. &Zeyh.	Monkhoane	Apiaceae	B0033	Roots	HIV	*Cussonia paniculate*	Decoction (Orally)	0.04	1.19
*Hypoxishemerocallide*asyn.	Moli	Hypoxidaceae	B0034	Roots	Gonorrhoea	*Solanum aculeatissimum*, *Berkheyamontana*, *Bulbinenarcissifolia*.	Decoction (Orally)	0.25	7.14
					Vaginosis	Agave *americana*, *Drimiadepressa*, *Eriocephaluspunctalus*, *Salvia runcinata*, *Eucomisautumnalis* and *Elephantorrhiza elephantine*.			

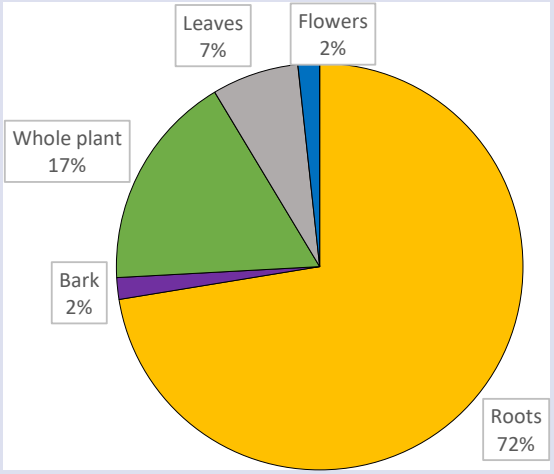

Figure 5: Plant parts used for preparation of remedies.

Plants used to treat sexually transmitted infections

Information on plants species used to treat STIs, local names (in Sesotho), families, scientific names, use value as well as frequency of citation was reported by traditional healers during ethnobotanical interviews is presented in table 3. The ethnobotanical survey revealed that 35 plant species that belong to 24 families are used for various STI's in the study area. The family with the largest number of useful species was from Asteraceae which amounted to 21% of all the mentioned species, followed by Fabaceae at 17% (Figure 5a). Asteraceae was also found to be one of the dominant families in an ethnobotanical study conducted in Limpopo province on plants used for STIs by Bapedi people.[30] In contrast to the findings of this study, Fabaceae was found to have the greatest number of plant species utilized to treat various diseases in earlier ethnobotanical studies.[17-55] Plants of the Asteraceae family have been used as astringents, antipyretics, anti-inflammatory, hepatoprotective, diaphoretics in fevers, smooth muscle relaxants, nerve tonics, laxatives, and for the treatment of wounds, bleedings, headaches, pains, and spasmodic illnesses, flatulence, dyspepsia dysentery, lumbago, leucorrhoea, haemorrhoids, ulcer, and disorders causing cachexia.[56] Additionally, other species such as *Achillea millefolium*, *Artemisia absinthium, Matricariarecutita, Parthenium hysterophorus, Inula crithmoïdes*from the family were found to contain bioactive compounds such as flavonoids (apigenin), phenolics (myricetin, ferulic acid,quercetin), Sesquiterpenic compounds, terpenoids, alkaloids and cardiac glycosides known to have various biological activities such as antioxidant, antimicrobial, anti-inflammatory and many other properties[57] which explains the dominance of plants from Asteraceae family in the current study.

The 10 most mentioned plants were *Bulbinenarcissifolia, Pentanisiaprunelloides, Dicomaanomala, Scambiosa columbaria, Xysmalobiumundulatum, Rumex lanceolatus, Eucomisautumnalis, Salvia runcinata* and *Hypoxishemerocallidea* (Figure 4). Most of the species mentioned by the traditional healers in Thaba 'Nchu were also mentioned in previous studies for the treatment STIs.[17-60] Plants such as *E. autumnalis, B. narcissifolia, P. prunelloides, S. runcinata*have biological properties such as antimicrobial, anti-inflammatory, antioxidant activities.[61-65] Therefore, the selection of these plants for preparation of remedies used to treat STIs by the informants may be attributed to the above-mentioned biological activities and indicates that the therapeutic properties of the plants are reliable and could thus possibly lead to the discovery of new bioactive compounds and products.[66]

Use value

The use value (UV) across all the mentioned plants ranged between 0.33 and 0.04. The UV for *P. prunelloides* (0.33), *B.narcissifolia* (0.29), *H. hemerocallidea* (0.25), *Salvia runcinata* (0.17), *Eucomisautumnalis* (0.17), *Dicomaanomala* (0.17), *R. lanceolatus* (0.17), *S. Columbaria* (0.17), *X.undulatum* (0.17), *D. depressa* (0.17) were the highest values (Table 3). Plants that were mentioned in most disease categories by many informants often have a high use value, whereas species that are only used by a few informants usually have a low use value.[66] This implies that the above-mentioned plant species are frequently used to treat a variety of STIs in the study area. The high use value of these plants indicates their extensive usage in the study area by traditional healers. These may also be due to their wide distribution in the area. High use values are also useful in indicating the importance of plants in treating STIs in the study area and can be selected in determining their safety, pharmacological effects and can influence the development of plant-derived products that can used to treat STIs in the study area.

The plant parts used for remedy preparation

The plant parts that are usually used for the preparation of remedies used to treat STIs are shown in figure 5. Roots were reported to be the most used plant part, followed by whole plant and leaves. This corroborates the Optimal Defence Theory[52,67] which states that humans select medicinal plants to optimize secondary chemistry and are likely to select plant organs that are less likely to be attacked by herbivores. However, the excessive use of roots and whole plants has a negative impact on the growth of plant populations, whereas the use of aerial plant parts would be more sustainable.[68,69] For example, El Houssine Bouiamrine *et al* (2017), Swemmer *et al* (2019)[70,71] and many other studies showed the importance of harvesting plants sustainably and further recommended the establishment programs of conservation and sensitization of rural populations on the protection of biodiversity. In addition, future research and interventions may also advocate for sustainable use of medicinal plants in the Thaba 'Nchu through the development of medicinal plant gardens and applying the measures recommended in the above-mentioned studies to reduce misuse and avert extinction.

Plant collection and method of preparation

The informants mentioned that they personally collect most of the plants they use to treat their patients and only buy and cultivate those that are difficult to access. For storage purposes, the plants are usually dried out and ground into fine powder. The informants mentioned that plants can be stored up to 5 years when ground into fine powder. Grinding the plants allows the solvent to have better contact with the plant material thus allowing better compound extraction and therefore increase efficacy in treatment of diseases.[72] The informants utilized most of the plants used for STI treatment in the research region individually or in combination. The use of a combination of plants species against a particular type of ailment may imply that the ailment is prevalent in that area of study.[73] Decoctions are the most often utilized remedy preparation method in the research area, possibly due to their simplicity of preparation and administration (Table 3). Herbal administration was mostly oral, and some plants were topically applied especially when treating skin infections (Table 3). This is consistent with other studies that previously documented that most remedies used for treatment of STIs were prescribed orally.[30-75]

CONCLUSION

The study documented the indigenous knowledge of medicinal plants used to treat symptoms of STIs in Thaba 'Nchu, Free state province, South Africa. The results showed that an overall of 35 medicinal plants from 24 families are used for treatment of various STIs such as Herpes zoster, vaginosis, pubic lice, HIV/AIDS, and Gonorrhoea. Majority of plants used by traditional healers for treatment of STIs are from Asteraceae, Fabaceae, Solanaceae and Hyacinthaceae families. *Bulbinenarcissifolia, Pentanisiaprunelloides, Hypoxishemerocallidea, Scabiosa columbaria, Xysmalobiumundulatum Rumex lanceolatus, Eucomisautumnalis, Dicomaanomala*and *Salvia runcinata*were frequestly used for treatment of ST's in the study area.Roots were the most used plant parts for preparation of different remedies and decoction is the common method of remedy preparation. Medicinal plants in the area might be endangered or go extinct in a long run due to the collection method and the use of roots for remedy preparation. Sustainable harvesting and use of medicinal plants to avoid further loss of plants needs to be encouraged. Many of these plants have previously been reported for antimicrobial activities which may justify their roles as natural remedies for sexually transmitted infections in this study. Further studies are needed to determine the dosages, minimum inhibitory concentrations, biological activities, and toxicities, and characterize the active phytochemicals. The plants recorded in this study can serve as a basis for further research of novel drugs that can used to treat STIs and other microbial infections.

CONFLICTS OF INTEREST

All the authors declare no conflicts of interest.

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