JBP
Journal of Biochemicals and Phytomedicine
eISSN: 2958-8561

A Systematic Review and Perspective Analysis of Medicinal Plants Used in Zimbabwe for the Treatment and Management of Genitourinary Infections

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ARTICLE INFO

Article Type:
Review

Article History:
Received: 24 Jun 2024
Revised: 03 Aug 2024
Accepted: 29 Oct 2024
Available online: 31 Dec 2024

Keywords:
Medicinal plants,
Genitourinary tract infections,
Sexually transmitted infection,
Urinary tract infection,
Zimbabwe

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ABSTRACT

The use of traditional medicinal plants for healthcare in Zimbabwe is widespread, with approximately 80% of the population relying on these plants for primary healthcare needs. This practice is supported by the World Health Organization's endorsement of their safety and efficacy. Notably, plant-based medicines are commonly employed in the management of genitourinary infections (GUIs), a significant health concern, particularly among immunocompromised individuals. This study reviews the documented properties of medicinal plants traditionally and currently used for managing GUIs in Zimbabwe. A comprehensive literature search was conducted through online databases such as ScienceDirect and PubMed. Medicinal plants used for GUIs were identified and compiled from various published sources, including abstracts, journal articles, scientific reports, book chapters, textbooks, and theses from Zimbabwean and international university repositories. An ethnobotanical survey identified 119 medicinal plant species belonging to 44 families and 100 genera. Of these, 82% have undergone scientific validation, demonstrating pharmacological efficacy and potential as sources of novel therapeutic agents. Approximately 55% of the identified plants have been subjected to toxicological evaluation, while 45% remain unassessed. Among 65 plants tested for toxicity, 63.08% were found to be non-toxic and safe for therapeutic use. However, a few traditionally used plants have shown high toxicity. Given the widespread use of these plants, there is an urgent need for comprehensive toxicological studies to ensure their safety. While most traditionally used plants have been reported as effective for managing GUIs, elucidating the toxicological profiles of all these plants remains critical to mitigate potential health risks.

Please cite this paper as:
Nyagumbo E, Nyirenda T, Mawere C, Mutaramutswa AM, Ngorima G, Kapanga DT, et al. A systematic review and perspective analysis of medicinal plants used in Zimbabwe for the treatment and management of genitourinary infections. Journal of Biochemicals and Phytomedicine. 2024; 3(2): 100-158. doi: 10.34172/jbp.2024.24.

Introduction

Genitourinary tract infections are a source of morbidity in both the general population and individuals with compromised immune systems. Among the immunocompromised population, two key groups at risk for genitourinary infections are individuals with human immunodeficiency virus (HIV) infection and transplant recipients (Amaya-Tapia et al., 2023). These infections can be broadly categorized into two groups: urinary tract infections (UTIs) and genital tract infections (GTIs). UTIs encompass various conditions such as cystitis, pyelonephritis, and prostatitis (Mancuso et al., 2023). Genital tract infections include urethritis, cervicitis, epididymitis, genital ulcerative diseases, endometritis, and pelvic inflammatory disease (Lanfranco and Alangaden, 2016; Rivero et al., 2023; Kim et al., 2024). UTIs are highly prevalent bacterial infections globally, affecting approximately 11% of the global population annually (Singh, 2023). These infections pose significant public health challenges due to their high incidence, associated morbidity, and the increasing prevalence of antimicrobial resistance.

While conventional antibiotics can be life-saving, they can also cause harm when not used properly (Neu, 1992; Jensen et al., 2022). The World Health Organization (WHO) has recognized the safety and efficacy of herbal drugs, stating that their historical use is a valid proof of their safety unless there is scientific evidence of danger (WHO, 2002). Medicinal plants have been a vital part of human healthcare for thousands of years, with over 80% of the global population relying on traditional plant-based medicines for primary healthcare needs (Silveira and Boylan, 2023). The use of traditional medicines has gained increasing popularity due to concerns about the invasiveness, expense, and potential toxicity of conventional Western medicine (Silveira and Boylan, 2023). Many cultures have used medicinal plants to treat various diseases and disorders, including urinary tract infections (UTIs), for centuries (Neu 1992). This suggests that medicinal plants have been safely used for centuries to treat various health issues, and their use continues to be a valuable alternative for establishing a healthy body environment. According to Hossan et al (2010), a survey was conducted in Bangladesh to gather information on the use of medicinal plants by traditional healers from different ethnic groups to treat urinary tract infections (UTIs) and sexually transmitted diseases (STDs). Interviews were conducted in the local dialect to collect data on the specific plant parts used, the ailments treated, the formulations, and the dosages. The survey identified 31 plant species used for UTIs, including symptoms such as leucorrhea, frequent or infrequent urination, cloudy urination, and burning sensations during urination.

Medicinal and aromatic plants have been used all over the globe to treat various ailments. This is further buttressed by the fact that 80% of the wolrd rely on plants as therapeutic options against diseases (Jeruto et al, 2015). Renewable resources like plants have been used in Aryuveda, African and Chinese medicine for years to deal with sexual transmitted infections (Dembetembe et al., 2023). African traditional medicine employs species like Aloe ferox for broad STI treatments (Dembetembe et al., 2023). Herbal medicines are effective as they can boost health living. The advantages of phytomedicines are that they are cheap, accessible and are part of the huma culture and civilization (Ekor, 2014). The bone of contention now rises with regard to safety, dosage, adverse reactions and contraindications of the herbal medicines being not clearly known (Ekor, 2014). Most of the plants have little or no records that have been validated scientificically. Public health also becomes a threat to the use of herbal medicines, if the conventional practioners are not taught on the use of the complementary alternatives.

In Zimbabwe, the treatment of genitourinary infections using herbal medicines is a common practice, deeply rooted in traditional healing methods. Ethnobotanical surveys in Zimbabwe have reported the use of medicinal plants to treat and manage various GUIs with a notable study by Kambizi and Afolayan, in 2001 which focused on plants used for treating sexually transmitted diseases (Njovhera) in Guruve District. These herbal plants are commonly used to treat urogenital schistosomiasis. Various plants are Utilised for their therapeutic properties, particularly for conditions such as urinary tract infections (UTIs) and sexually transmitted infections (STIs). Notable examples medicinal plants used to STIs in Zimbabwe includes; Ozoroa insignis, Annona stenophylla, Commiphora marlothii, Lannea edulis, Catharanthus roseus and Rhus dentata (Maroyi, 2013). These plants are part of a broader traditional medicinal system that emphasizes the use of local flora to address health issues, including STIs. This article provides a systematic review of medicinal plants used in Zimbabwe for the treatment of urinary and genital infections, evaluating the existing pharmacological and toxicological assessments. The artricle therefore helps in conscietising the public on safer use of medicinal plants.

Materials and Methods

This study aimed to record and document the medicinal plants that are used traditionally to treat genitourinary infections in Zimbabwe. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR) protocol (Page et al., 2021) was employed in this study where two members of the research team reviewed literature from databases, registers and websites, as well as books (see Figure 1). No ethical approval was required for this scoping review.

Search Strategy and Identification of Records

A variety of ethnobotanical books, as well as multiple peer reviewed journal articles, were consulted to compile this list. The online resources Google Scholar, PubMed, JSTOR, and ScienceDirect were used to identify and access original scientific research studies. The following search terms were used: "medicinal plants, sexually transmitted diseases, sexually transmitted infection, urinary tract infection, Zimbabwe". Appropriate Boolean operators (AND) were used to refine searches in the online databases. Zotero reference management software was then used to extract data from websites, retrieve articles from aforementioned databases as well as to identify duplicates on imported data. Google search was then done for grey literature and to retrieve bibliographies of studies cited in reports included for this review. Websites and organisations such as university libraries were then used for unpublished data or grey literature.

Screening

Two independent reviewers (CM and TN) conducted a screening of the retrieved articles by evaluating their titles and abstracts to assess their relevance to the study. The first reviewer (CM) screened all the titles. The second step thus involved screening of abstracts of articles that passed the title screening. This was done against the predefined eligibility criteria by two reviewers (CM and TN), independently, in duplicate. Discrepancies were discussed and resolved by consensus and/or by the principal investigator (EN). The eligible articles were then assessed further for inclusion in the study using the inclusion/exclusion criteria. In so doing the responses of the two reviewers were calibrated for consistency in the application of the eligibility criteria in the screening process. Finally, a single "calibrated" reviewer (CM) assessed all the remaining titles and abstracts to identify potential full-text records. Full-text screening was performed by at least two authors independently (CM screened all the records, and duplicate assessment was conducted by AM, TN, or WP), with discrepancies resolved via discussions or by consulting a third reviewer. Data related to review characteristics, results, key findings, and conclusions were extracted by at least two reviewers independently (TN performed data extraction for all the reviews and duplicate extraction was performed by AM, or CM). Retrieved full text articles were then assessed for eligibility.

Eligibility Criteria

The precise keywords mentioned above were used to search peer-reviewed journal publications and ethnobotanical books. To determine their applicability to this investigation, published research were located and their abstracts were reviewed. After that, the complete texts of those that were thought to be pertinent were carefully reviewed to make sure the requirements for eligibility were fulfilled.

Inclusion Criteria

In determining the study's eligibility, the following inclusion criteria were taken into account: (i) Publications written in English and prior to March 2021 were used in this review. (ii) We did not favour any taxonomy in our investigation and it was impartial. (iii) Only plant species that have been documented to cure genitourinary diseases in humans alone were included in the ethnobotanical study (Table 2). Moreover, literature containing full information on the scientific and family name, part used, preparation method and type of ailment treated by medicinal plants was taken into account. Unless it was established that the plants were explicitly utilised to treat genitourinary diseases, all records of plants being used to treat individual generic symptoms were disregarded. (iv) No ethnic group's traditional knowledge was found to be more valuable than any other in our investigation. Although the majority of these species are indigenous to Zimbabwe, certain introduced plants were included as they have been assimilated into at least one ethnic group's traditional medical practices. (v) Regardless of whether the focus of the study was genitourinary infections or the bacteria tested were chosen because of their association with a different disease, only studies that screened against the major bacterial causes of genitourinary infections were included in the pharmacological studies shown in Table 3. (vi) Only studies screening against the common causes of genitourinary infections were evaluated in this review, irrespective of their focus. Studies that, for instance, screened plants

for E. coli were incorporated into our analysis, even though their primary focus was on gastrointestinal disorders as opposed to genitourinary infections. (vii) Research on ethnobotany of Zimbabwe's flora was limited. (viii) Each paper was to be an original research or protocol (not review). Moreover, independent of the study's origin, a summary of the biology in vivo and in vitro as well as the toxicity screening of medicinal plants for bacterial pathogens that cause genitourinary infections is included.

Exclusion Criteria

A selection of studies was made based on the following criteria: (i) The Plant List (http://www.theplantlist.org/) and other sources were utilised to verify species identification in cases where name changes and plant species families were observed, especially in older publications. (ii) Plant species that were shown to alleviate general genitourinary infection symptoms that are typical of various illnesses, but did not clearly state that they were used to treat genitourinary infections, were not included in this study. (iii) Excluded were studies that used a screening method to identify bacteria that exclusively cause genitourinary infections as a secondary cause of other disorders. Consequently, this study did not include trials that screened plants for S. aureus, which exclusively causes urinary tract infections as a result of blood infections. (iv) The study did not include the usage of invasive plant species until at least one ethnic group in Zimbabwe uses them extensively in traditional medicine. (v) Data from the review and thesis were excluded from the review.

Data Collection

The articles retrieved were screened for study relevance by two independent reviewers (CM and TN), who assessed the titles and abstracts. Full-text studies were graded for quality according to the Downs and Black checklist (studies that scored≤14 points were ranked as 'poor'; 15–19 points as 'fair'; and 20–25 points as 'good') (Downs and Black, 1998).

The relevant data about medicinal plants that treat genitourinary infections was retrieved using a pre-designed Microsoft Excel format. Extracted data included: (i) The names of the species, families, and common names for each species as stated in the individual publications were gathered; (ii) Common names and names used by various ethnic groups were gathered from the individual publications (iii) Where applicable, data on plant part utilisation, preparation techniques, and administration routes were collected and subsequently verified for completeness by two independent reviewers (CM and TN).

Data Analysis and Synthesis

Descriptive statistical methods were used to analyze the collected data, with results presented as percentages and frequencies in tables and charts. SPSS statistical software (version 20, IBM Inc.) was used for further data analysis. Graphical representations in the form of bar charts and pie charts were generated to assess the extent to which included studies adequately addressed individual items pertaining to the checklist elements related to abstract and introduction, methods, results, and discussion. The categories of key elements within each step were discussed and agreed by all the authors. Results of the included reviews were then tabulated and summarized descriptively, along with a discussion on any overlap in the primary studies.

Results and Discussion

Our searches returned over 1600 manuscripts as shown in Figure 1. A comma separated values (csv) file was generated for analysis upon export of library data from Zotero. Duplicates and ineligible studies were then removed prior to screening of records. Two authors then screened 1322 remaining articles based on titles and abstracts for eligibility. Most of the screened titles (976) and abstracts (179) were excluded for not being specific or relevant to genitourinary infections. Of the 167 reports that were sought for retrieval, 61 were not open access as they demanded institutional subscription or direct purchase to retrieve. However, majority of excluded studies were reviews, thesis, were not relevant to genitourinary infections or were from outside Zimbabwe. Of the 10 studies included, two are reviews, and eight are experimental studies. The total number of relevant papers was acceptable by international standards, which made the authors to consider more grey literature (Total= 199 reports) from organisations, websites, Google search and retrieve referenced citations for data on pharmacology and toxicology of medicinal plants used in Zimbabwe for management of genitourinary infections. Following exclusion of theses when the reports were assessed for eligibility, 209 studies were included in the review. These records that reported on medicinal plants used treatment of genitourinary infections in Zimbabwe demonstrate a huge research gap that need to be filled for generation of indigenous knowledge and scientific validation.

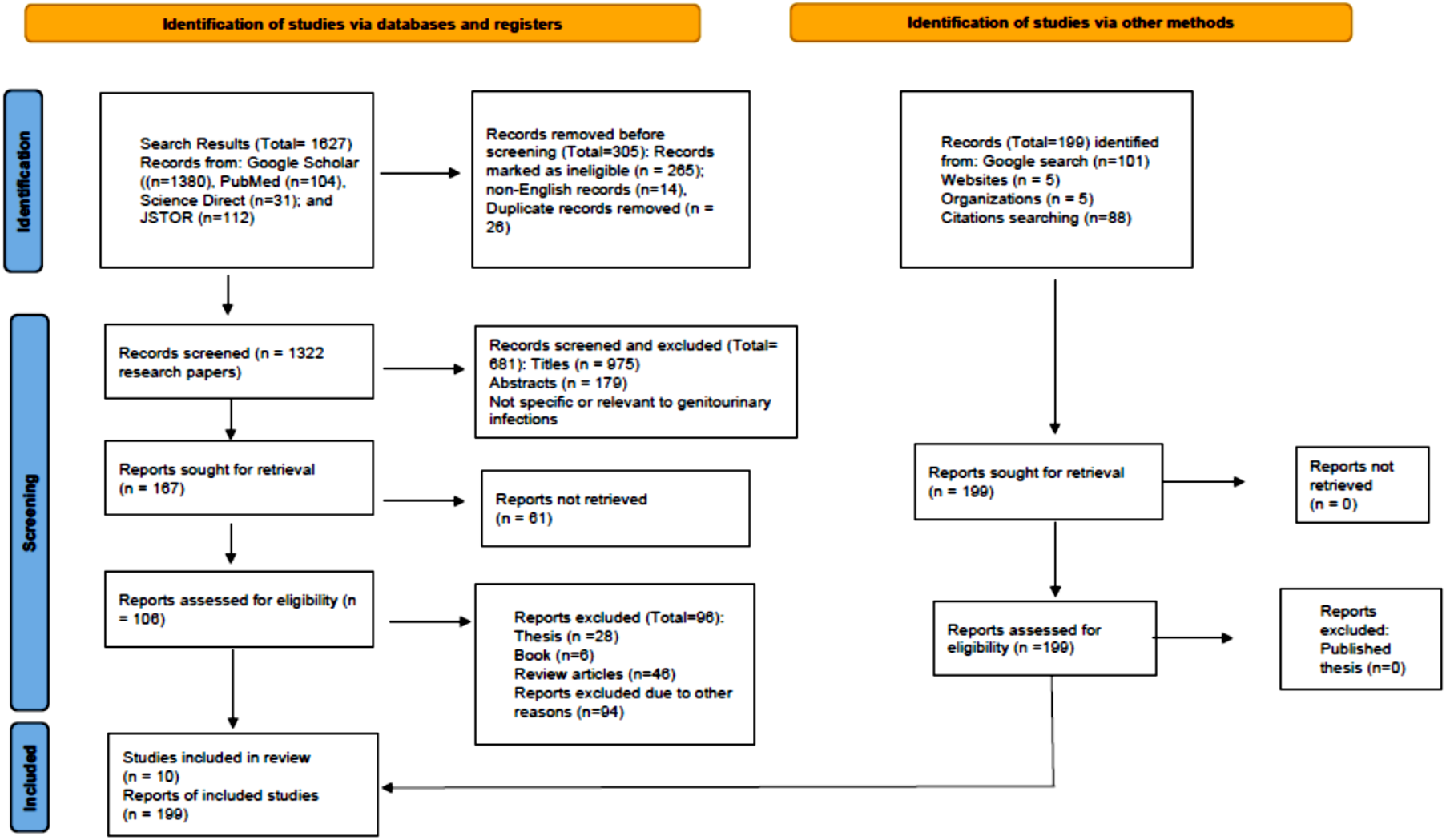

Figure 1. PRISMA Flow Diagram (adopted from Page et al., 2021).

Ethnobotanical and Geographic Distribution of Medicinal Plants for GUIs in Zimbabwe

Ethnomedicinal and ethnobotanical studies provide fundamental information about medicinal plants traditionally used and their potential applications in modern medicine. They are valuable strategies for discovering new drugs (Nasim et al., 2022).

In the present review, a total of 119 medicinal plant species were identified for their traditional applications in the treatment of genitourinary infections. The identified medicinal species are distributed across 100 genera and 44 families as indicated in Figure 2. The family Fabaceae comprises the largest proportion of collected medicinal species (19 species), followed by Asteraceae (10 species). The prevalence of the Fabaceae and Asteraceae families can be attributed to their extensive species diversity. The top three prominent families in the African medicinal flora are Fabaceae, Asteraceae, and Rubiaceae. The Fabaceae family, found in numerous countries, has been widely reported as dominant in the treatment of various human and animal infections (Papo et al., 2022). The Fabaceae family includes 600 genera and 12,000 species of herbs, shrubs, trees, and vines with ethnopharmacological use (Mongalo and Raletsena, 2022).

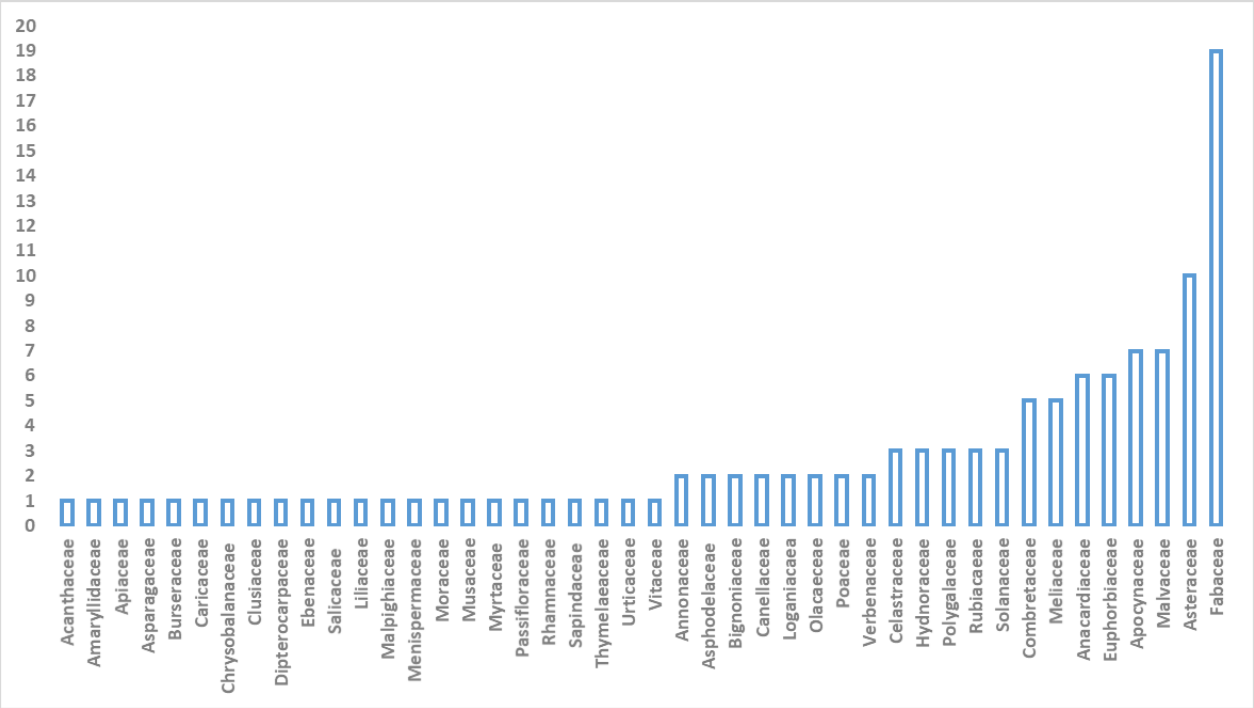

Figure 2. Diversity of plant families among medicinal plants used for the treatment and management of genitourinary infections (GUIs) in Zimbabwe

The highest represented genera were Vernonia with 4 plant species (Figure 3), reported single genera at 72.3% and multiple genera at 27.7 %. From the documented plant genera, Vernonia was the most common genera used in the treatment of genitourinary infections in Zimbabwe. From the documented plant genera, Vernonia was the most common genera used in the treatment of genitourinary infections in Zimbabwe. Vernonia species, commonly known as Bitter leaf, hold an importance in African traditional medicine. They are Utilised for treating various severe human and animal ailments. A wide range of important pharmacological activities they possess include antimicrobial, antidiarrhoeal, antipyretic, antimalarial, antidiabetic, anti-inflammatory, antioxidant, immunological and antiproliferative properties.

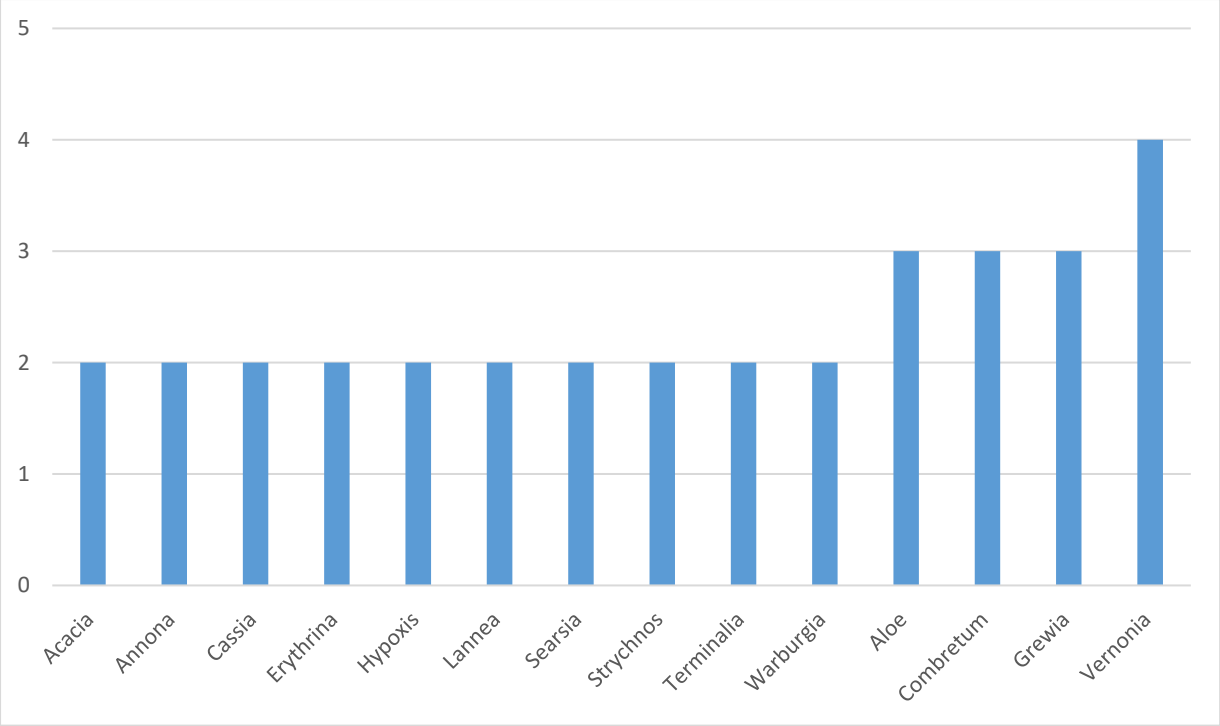

Figure 3. Plant species' genera divesity of medicinal plants used to treat and manage genitourinary infections (GUIs) in Zimbabwe

Aloe spp species stand out, as there have been used for over 5000 years, Egyptians, Romans, indigenous peoples of Africa, Asia, and the Americas have used them to treat burns, ulcers, and surgical wounds (Shedoeva et al., 2019).

Traditional practitioners routinely prescribe combinations of medicinal plant species (Table1) to increase their therapeutic efficacy and minimize negative effects (Yuan et al., 2017). According to traditional folklore, medicinal herbs can be used alone or in combination to heal internal and external sores, inflammation, and discomfort brought on by infections (Naidoo et al., 2013; Lawal et al., 2019).

Plant based medicinal systems are also known to include a combination therapy approach in dealing with disease (Van Vuuren et al., 2022). The use of synergistic approach to handling disease is crucial, and is done through mixing two different herbal compounds or more to produce one powerful concoction as reflected in Table 1.

Polyherbal formulations are measured on the synergistic, antagonistic scale, additive and no change (Parveen et al., 2021; Van Vuuren et al., 2022). Improved efficacy of a formulation based on polyherbal extract is linked to its synergistic impact. Here the pharmacological properties are improved and better results observed due to the enhanced phytochemical constituents (Van Vuuren et al., 2022). Combination therapy has a role in the magnification and potency enhancement of the single herbs when combined together.

Table 1: Ethnomedicinal uses of plant species concoctions and mixtures with other plant species.

Plant name	Concoctions and mixtures
Abelmoschus esculentus	Root: infused with roots of Manihot esculentus and it's taken by mouth.
Adenia gummifera	Root: Infused with roots of Dicoma anomala and infusion is taken orally.
Aloe spp.	Leaves: Infused with roots of Cassia abbreviata and Elephantorrhiza goetzei.
Annona senegalensis Annona stenophylla	Root: Infusion fused with Securidaca longipedunculata, Lannea edulis and Elephatorrhizia goetzei. Root crushed, mixed with hot water, extract drunk.
Erythrina abyssinica	Root: Infused with roots of Turraea nilotica. Root infusion from fresh or dried part of roots.
Lannea edulis	Root: Infusion. Cooked with seeds of Vigna unguiculata and the soup is taken by mouth.
Solanum lycopersicum	Root: Mixed with roots of Capsicum spp. and infusion taken orally.
Ricinus communis	Root: Powder mixed with juice from fruit of Solanum spp. and mixture is rubbed on penile sore.

Table 2: Medicinal plants utilised for the treatment and management of genitourinary infections in Zimbabwe

Family	Scientific names	Growth habit	Vernacular and local names	Plant Parts Utilised and Methods of Preparation	GUI condition/s	Other Ethnomedicinal uses	Distribution	Sources
Malvaceae	*Abelmoschus esculentus L. Moench*	Annual herb	Derere (Shona) Derere rechipudzi (Shona) Idelele (Ndebele) Lady's fingers (English) Okra (English)	Root: infused with roots of Manihot esculentus and it's taken by mouth.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	No information	N, W, E	(Gelfand et al., 1985)
Fabaceae	*Acacia karroo Hayne*	Tree	Muvunga, Muhwa Isinga (Ndebele) Mubayamhondoro (Shona) Muhunga (Shona) Muzunga (Shona) Sweet thorn (English)	Root: decoction drunk. Infusion to treat gonorrhoea Fruit and root: Ground into powder and applied on penile sores to treat syphilis.	Gonorrhoea and syphilis	General body pain	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2013a, 2017a; Chigora et al., 2007)

Fabaceae	*Acacia nilotica (L.) Willd. ex Delile,*	Small to medium sized tree	Mubayamhondoro, Muhunga, Muzunga (Shona) Scented-thorn (English) Umlaladwayi, Isanqawe (Ndebele)	Roots: infusion from fresh or dried part of roots Fruit: ground fruit into powder and applied on penile sores	STD	No information	N, E, W, S, C	(Kambizi and Afolayan, 2001)
Passifloraceae	*Adenia gummifera (Harv.) Harms*	Robust, semi-woody climber or liane.	Deveramvumi (Shona) Dovoza (Shona) Monkey rope (English) Muboori (Shona) Muhore (Shona) Snake climber (English)	Root: Infused with roots of Dicoma anomala and infusion is taken orally.	Venereal diseases	To prevent abortion, to prevent epidemics, madness, emetic, epilepsy, dysmenorrhea, painful uterus and diarrhoea.	N, E, W, S, C	(Gelfand et al., 1985)
Fabaceae	*Albizia antunesiana Harms*	Tree	Muriranyenze (Shona) Purple-leaved albizia (English) Umnonjwana (Ndebele)	Roots: root crushed and extract drunk (cold) Infusion	Gonorrhoea	Abdominal pain. Tonsillitis, sore throat, painful vagina, purgative, sore eyes, painful uterus and constipation.	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2011, 2013a)
Asphodelaceae	*Aloe globuligemma Pole Evans*	Stemless succulent perennial herb	No information	Leaves: Leaves infusion taken orally	Venereal diseases	Abdominal and stomach pains	W, E, S	(Gelfand et al., 1985; Kambizi and Afolayan, 2001)
Asphodelaceae	*Aloe greatheadii Schönland*	Single stemless plants	Greathead's spotted leaf aloe (English)	Leaves: infusion of chopped leaves or local application on sores of sharp ends of leaves. Leaves: hot water extract drunk	Gonorrhoea and STD	Constipation	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2011, 2013a)
Liliaceae	*Aloe spp.*	Succulent perennials, sometimes large and shrub-like	No information	Leaves: Infused with roots of Cassia abbreviate and Elephantorrhiza goetzei	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) and syphilis.	Constipation, diarrhoea, dysmenorrhoea, infertility in women, wounds, paralysis, cough, vomiting blood, and to cause abortion.	N, E, W, S, C	(Gelfand 1956; Gelfand et al.,1985)

Annonaceae	*Annona senegalensis*	Tree	Muroro (Shona) Wild custard apple (English) Ububese (Nddebele)		Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) and syphilis	No information	N, E, S	(Gelfand et al., 1985)
Annnonaceae	*Annona stenophylla Engl. & Diels subsp. nana (Exell) N. Robson*	Shrub	Muroro (Shona) Dwarf custard-apple (English)	Root: Infusion fused with Securidaca longipedunculata, and Lannea edulis and Elephatorrhizia goetzei. Root crushed, mixed with hot water, extract drunk	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) and syphilis	Abdominal pains, hiccoughs swelling on the body, antiemetic, constipation, boils, dilated veins around umbilicus, chest pains, dysmenorrhea and diarrhoea in blood.	N, E, W, S, C	(Gelfand et al., 1985: Kambizi and Afolayan, 2001; Maroyi, 2011, 2019c)
Fabaceae	*Bauhinia fassoglensis Schweinf.*	Climber	Creeping bauhinia (English) Gwangwandiza (Shona) Marama bean (English) Mubopo (Shona) Mudamura (Shona) Mutukutupasi (Shona) Tamani berry (English) Umbama (Ndebele) Umdabule (Ndebele)	Tuber: Tuber dried and ground into powder and added to porridge	Venereal diseases	Pneumonia, diarrhoea and retained placenta.	N, E, W, S, C	(Gelfand et al., 1985)
Asteraceae	*Brachylaena discolor DC.* *var. rotundata*	Deciduous shrub or small tree.	No information	Root: Infusion taken orally.	Syphilis	Abdominal pains and dysmenorrhea.	N, E, W, S, C	(Gelfand et al., 1985)
Fabaceae	*Brachystegia boehmii Taub.*	Tree	Itshabela (Ndebele) Mfuti (Shona) Mupfuti (Shona) Prince of Wales' feathers (English)	Bark: extract drunk	STI	No information	N, E, W, S, C	(Maroyi, 2013a)
Asclepiadaceae	*Caralluma spp*		No information	Root: Ashes applied on penile sore	Syphilis	No information	N, E, W, S, C	(Gelfand et al., 1985)

Caricaceae	*Carica papaya L.*	Tree	Melon-tree (English) Papaya (English) Pawpaw (English)	No information	Venereal diseases	No information	Cultivated	(Gelfand et al., 1985)
Apocynaceae	*Carissa spinarum L.*	Tree	Mudyabveni (Shona) Mudzambara (Shona) Muhlababzunzi (Shona) Mumbingwa (Shona) Muruguru (Shona) Mutsamviringa (Shona) Simple-spined num-num (English) Umlugulu (Ndebele)	Root: Infusion taken orally.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Pneumonia, abdominal pains, cataract, headache, epilepsy, general body pains, infertility in women, cough, asthma, chest pains, abscess, chest pains and shortness of breath.	N, E, W, S, C	(Gelfand et al., 1985)
Fabaceae	*Cassia abbreviata Oliv.*	Tree	Isihaqa (Ndebele) Long-tail cassia (English) Muremberembe (Shona) Muvheneka (Shona)	Root: Infusion Roots: root crushed; hot extract drunk as cold extract Bark: infusion from fresh or dried part of bark	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) and STD.	Abdominal pain, diarrhoea, backache, abortion and constipation.	N, E, W, S, C	(Gelfand et al., 1985; Kambizi and Afolayan, 2001; Viol, 2009; Shumba et al., 2009; Maroyi, 2011, 2013a)
Fabaceae	*Cassia singueana Del.*	Tree, shrub over 2 m.	Isihaqa esincinyane (Ndebele) Mudyamhungu (Shona) Munzungu (Shona) Mushayanyoka (Shona) Scrambled egg (English) Sticky pod (English) Winter cassia (English) Winter-flowering senna (English)	Root: Salt is added, then the mixture is burnt and the ashes are rubbed on incisions on the swollen glands. Roots: infusion from fresh or dried part of roots	Syphilis and STD	Sore eyes, abdominal pains, painful uterus, antiemetic, dysmenorrhea and failure of umbilical cord to fall.	N, E, W, S, C	(Wild and Gelfand, 1959; Gelfand et al., 1985; Kambizi and Afolayan, 2001)
Rubiaceae	*Catunaregam taylorii (S. Moore) Bridson*	Shrub or small tree	Murovaduri (Shona)	Leaves	Gonorrhoea and syphilis	Intestinal worms	Cultivated	(Mangoyi et al., 2014)
Menispermaceae	*Cissampelos mucronata A. Rich.*	Liane with a woody rootstock.	Hairy heartleaf (English) Heart-leaved vine (English) Nyakuta (Shona) Ruzambu (Shona)	Root: Root infusion	Venereal diseases	Abdominal pains, depressed fontanelle, dysmenorrhoea, backache, infertility, swelling on the body, sore eyes, sore throat, diarrhoea, swollen stomach, painful uterus and menorrhagia.	N, E, W, S, C	(Gelfand et al., 1985)

Verbenaceae	*Cleodendrum ternatum Schinz*	Suffrutex growing from an extensive rhizomatous woody rootstock.	Dwarf cat's whiskers (English) Umalanjana (Ndebele) Umqotshanja (Ndebele)	Root: Infusion taken orally.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Fits, backache, constipation, fever, mental illnesses, to put foetus in the correct position, against tapeworm and hookworm, and prevent eyes becoming sore.	N, E, W, S, C	(Gelfand et al., 1985)
Combretaceae	*Combretum erythrophyllum (Burch.) Sond*	Tree	Chitiswati (Shona) Mudhuvu (Shona) Mudiki (Shona) Mupuma (Shona) Mutepe (Shona) River bushwillow (English) Umdubu (Ndebele)	Root: Inserted into the vagina.	Cure or preventative for venereal diseases.	Aphrodisiac and to reduce the size of vaginal orifice.	N, E, W, S, C	(Gelfand et al., 1985)
Combretaceae	*Combretum hereroense Schinz subsp. hereroense*	Shrub or small tree.	Ithetshane (Ndebele) Mouse-eared combretum (English) Murovamhuru (Shona) Mutechani (Shona) Russet bushwillow (English)	No information	Venereal diseases	No information	N, E, W, S, C	(Chinemana et al., 1985)
Combretaceae	*Combretum platypetalum Laws. subsp. oatesii (Rolfe) Exell*	A dwarf shrub with annual stems, typically less than 30 cm, growing from a woody rootstock.	Bepu (Shona) Dwarf red combretum (English) Red wings (English) Redwings (English)	Root: Ground into powder and mixed with porridge.	Kidney pains	Earache, burns, vomiting blood, infertility in women, abdominal pains, diarrhoea, to dilate the birth canal, antiemetic for infants, dysmenorrhoea and dilated veins around the umbilicus.	N, E, W, S, C	(Gelfand et al., 1985)
Burseraceae	*Commiphora marlothii Engl.*	Tree	Mupepe (Shona) Paperbark corkwood (English) Ikwazakwaza (Ndebele) Kabongobongo (Tonga: Zimbabwe) Mudyaroro (Shona) Mupepe (Shona) Umqoqodo (Ndebele)	Roots: extract drunk	STI	No information	N, E, W, S, C	(Maroyi, 2013a)

Acanthaceae	*Crabbea cirsioides (Nees) Nees*	Perennial herb.	Prickle head (English)	Root: Infusion taken orally.	Syphilis	Madness.	N, E, W, S, C	(Gelfand et al., 1985)
Amaryllidaceae	*Crinum macowanii Baker*	Bulb globose	Common vlei-lily (English)	Bulb: Ground into powder and added to porridge	Venereal diseases	Backache, emetic, to increase lactation and blood in the body	N, E, W, S, C	(Gelfand et al., 1985)
Euphorbiaceae	*Croton gratissimus Burch.*	Shrub or small tree	Gunukira (Shona) Lavender croton (English) Mubangwa (Shona) Mufandemengwe (Shona) Mufarata (Shona)	Bark and root	Swollen testicles and gonorrhoea.	Abdominal pains, cough and aphrodisiac.	N, E, W, S, C	(Gelfand et al., 1985; Mangoyi et al., 2014)
Apocynaceae	*Cryptolepis oblongifolia Schltr. Ectadiopsis oblongifolia* (Meisn.) Bullock	Erect small shrub	No information	Root: Infusion taken orally.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin), bladder problems and difficult in urination.	Abdominal pains, diarrhoea, constipation, antiemetic for infants, aphrodisiac, pneumonia, depressed fontanelle, sore eyes, cataracts and medicine for premature infants to strengthen them.	N, E, W, S, C	(Gelfand et al., 1985, Watt and Breyer-Brandwijk, 1962)
Vitaceae	*Cyphostemma junceum (Webb)* Wild & Drummond	Erect perennial herb	Zindakubaya (Shona)	Tuberous root: Infusion taken orally.	Venereal diseases	Abdominal pains, diarrhoea, to dilate birth canal, backache, fever, dysmenorrhoea and swelling on the body.	N, C, S	(Gelfand et al., 1985)
Solanaceae	*Datura stramonium* L.	Erect, usually dichotomously branched annual or short-lived perennial herb	Jimson weed (English) Thorn apple (English)	Leaves: Infusion taken orally.	Venereal diseases	Abdominal pains, goitre, cough, asthma and boil.	N, E, W, S, C	(Gelfand et al.,1985)
Fabaceae	*Dichrostachys cinerea* (L) Wight & Arn	Tree, shrub over 2 m	Mumhangara, Mupangara, Muruka, Musekera (Shona) Sickle bush, Chinese lantern (English) Ugagu (Ndebele)	Fruit: ground fruit into powder and applied on penile sores. Leaves Roots	STD, syphilis Venereal diseases Syphilis.	Abdominal pains, cough, influenza, scabies, pneumonia, diarrhoea with blood and backache.	N, E, W, S, C	(Gelfand et al., 1985; Kambizi and Afolayan, 2001; Viol, 2009)

Asteraceae	*Dicoma anomala* Sond	Perennial herb	Fever bush, stomach bush (English)	Tuber: Infusion taken orally. Root: Root infusion taken orally	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) and syphilis.	Abdominal pains, painful uterus, madness, bladder weakness in women, high temperature, backache, antiemetic, cataracts, sore throat, dizziness, antidote, prolonged labour, body pains, cough, remedy for all diseases and pneumonia.	N, E, W, S, C	(Gelfand et al., 1985; Chigora et al., 2007; Chota et al., 2020; Marekerah, 2015; Maroyi, 2018a)
Apocynaceae	*Diplorhynchus condylocarpon* (Muell. Arg.) Pich	Tree, shrub over 2 m.	Horn-pod tree (English) Inkamamasane (Ndebele) Musikanyimo (Shona) Mutohwa (Shona) Tsowa (Shona) Wild rubber (English)	Root: Infusion taken orally.	Venereal diseases	Abdominal pains, pneumonia, infertility, cough, measles, poor appetite and to rest sterility in men.	N, E, W, S, C	(Gelfand et al., 1985)
Malvaceae	*Dombeya rotundifolia* (Hochst.) Planch.	Small deciduous tree	Mukondotowa (Shona) Mupunduru (Shona) Musiyasitu (Shona) Mutohwechuru (Shona) Mutondokatura (Shona) Mutongotowa (Shona) Umwane (Ndebele) Wild pear (English)	Root: Infusion taken orally.	Syphilis	Madness.	N, E, W, S, C	(Gelfand et al., 1985)
Celastraceae	*Elaedendron matabelicum* Loes.	Tree	Murunganyama, Murungamunya (Shona) Condiment saffron (English) Umgugudu (Ndebele)	Roots	Venereal diseases and syphilis.	No information	N, E, W, S, C	(Gelfand et al., 1985)
Fabaceae	Elephantorrhiza goetzei (Harms)	Deciduous shrub, rarely a small tree, 1-4 m tall.	Muzezepasi (Shona) Intolwane (Ndebele) Mugudzuru (Shona) Narrow-pod elephant root (English)	Root: root crushed, mixed with hot water, extract drunk Root: Infusion	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) and syphilis.	Abdominal pains, diarrhoea, heart pains, depressed fontanelle and constipation	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2011, 2013a; Viol, 2009)

Meliaceae	*Entandoragma caudatum (Sprague) Sprague*	Tree, shrub over 2 m.	Mubhanana (Sh) Wooden banana (Eng) Umsikili (Nd)	Fruit peels: the peels of the fruit tare burnt in a potsherd, mixed with vaseline and applied to genital area	Genital warts	No information	N, E, W, S, C	(Kambizi and Afolayan, 2001; Chigora et al., 2007)
Fabaceae	*Eriosema englerianum Harms*	A many-stemmed perennial, growing from a woody rootstock.	Blue bush (English) Mashona fire bean (English)	Root: Infusion	Venereal diseases	Bilharziasis, painful uterus, wasting in infants, backache and infertility in women.	N, W, C	(Gelfand et al., 1985)
Fabaceae	*Erythrina livingstoniana Baker*	Tree	Aloe coral-tree (English)	Root: Infusion	Blood in urine	No information	N, E, S	(Gelfand et al., 1985)
Fabaceae	*Erythrina abyssinica Lam. ex DC.*	Tree	Lucky-bean tree (English) Munhimbiti (Shona) Mutete (Shona) Mutiti (Shona) Mutsiti (Shona) Red-hot-poker tree (English) Umgqogqogqo (Ndebele)	Root: Infused with roots of Turraea nilotica. Root infusion from fresh or dried part of roots	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Diarrhoea, backache, cough, abdominal pains, body pains, bilharziasis, wounds in mouth, measles and wasting in infants	N, C, E, S	(Gelfand et al., 1985; Harvey, 1962; Kambizi and Afolayan, 2001)
Ebenaceae	*Euclea natalensis A DC*	Shrub	Chipambati (Shona) Large-leaved guarri (English) Murunze (Shona) Mushangura (Shona) Natal guarri (English) Nyakabvuri (Shona)	Root and Leaves: Charred and powdered root, leaf sap applied topically or leaf, root decoction taken orally	Gonorrhoea, sexually transmitted infections (STIs), syphilis and venereal diseases.	Anthelminthic, asthma, bronchitis, chewing sticks, hookworm, malaria, mouthwash, rabies, schistosomiasis, scrofulous swellings, toothache, tuberculosis and yellow fever	N, E, W, S, C	(Maroyi, 2019c)
Euphorbiaceae	*Euphorbia tirucalli L.*	Tree, shrub over 2 m, shrub under 2 m.	Hejiyemukaka (Shona) Ingotsha (Ndebele) Rubber euphorbia (English) Rubber hedge plant (English) Rusungwe (Shona)	Root: Infusion taken orally.	Gonorrhoea	Antidote to poison and poison	N, E, W, S, C	(Gelfand et al., 1985)

Moraceae	*Ficus sur Forssk.*	Tree	Muonde (Shona) Broom-cluster Fig (English) Cape Fig (English)	Roots: extract drunk	Syphilis	No information	N, E, W, S, C	(Maroyi, 2011, 2013a)
Salicaceae	*Flacourtia indica (Burm.f.) Merr.*	Tree, shrub over 2 m.	Batoka plum (English) Governor's plum (English) Mududwe (Shona) Munhunguru (Shona) Mutombototo (Shona) Mutudza (Shona) Mutunguru (Shona)	Root: Infusion taken orally.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	To prevent conception, body pains, rumbling stomach, teething in infants, to prevent sore eyes, bilharziasis, cough, chest pains, heavy menstruation, pneumonia, painful uterus, abdominal pain in infants and diarrhoea.	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2011, 2013a)
Thymelaeaceae	*Gnidia capitata (L.f.) Burtt Davy*			Root: Infusion taken orally.	Venereal diseases	Tonsillitis and asthma.	N, E, W, S, C	(Gelfand et al., 1985)
Malvaceae	*Grewia bicolor Juss.*	Shrub	Mutetwa Mutongoro (Shona) Mwingili (Tonga: Zimbabwe) Ndeywa (Tonga: Zimbabwe) Ngiri (Tonga: Zimbabwe) Sihane (Hlengwe) Umhlampunzi (Ndebele) Umpumpulwane (Ndebele) White-leaved raisin (English)	Roots: hot extract drunk	Gonorrhoea	No information	N, E, W, S, C	(Maroyi, 2011, 2013a)
Malvaceae	*Grewia flavescens Juss.*	Scrambling shrub	Donkey-berry (English) Mubhununu (Shona) Mujonjoma (Shona) Mumhudzungwa (Shona) Sandpaper raisin (English) Ubhunzu (Ndebele) Umklampunzi (Ndebele)	Root: Infusion taken orally.	Syphilis	Diarrhoea in infants, measles, heavy menstruation, inflammation of the navel cord of an infant and depressed fontanelle.	N, E, W, S, C	(Gelfand et al., 1985)

Malvaceae	*Grewia monticola Sond.*	Tree	Asegaai wood (English) Donkey berry (English) Grey raisin (English) Ibusu (Ndebele) Mubura (Shona) Muguramhanda (Shona) Munjiri (Shona) Mupimbiri (Shona) Mutewa (Shona) Mutongoro (Shona) Ngiri (Tonga: Zimbabwe) Sihane (Hlengwe) Silver raisin (English) Umhlampunzi (Ndebele) Umpumpulwane (Ndebele) Umtewa (Ndebele)	Root: Infusion taken orally.	Syphilis	Diarrhoea, aphrodisiac and infertility in men.	N, E, W, S, C	(Gelfand et al., 1985)
Celastraceae	*Gymnosporia senegalensis (Lam.) Loes.*	Tree, shrub over 2 m.	Chivhunabadza (Shona) Chizhuzhu (Shona) Confetti tree (English) Isihlangu (Ndebele) Mugaranjiva (Shona) Mukokoba (Shona) Musosaguva (Shona) Musosawafa (Shona) Musukameno (Shona) Mutotova (Shona) Mutsotsova (Shona) Red spike-thorn (English)	Leaves and root: Infusion	Venereal diseases	Pneumonia, sore throat, earache, tuberculosis, cough, bilharziasis, fever, wounds in mouth, measles, aphrodisiac, bronchitis, painful uterus, to prevent abortion, constipation, diarrhoea, backache, epilepsy, to dilate the birth canal, inflammation of the navel cord of an infant and dysmenorrhea.	N, E, W, S, C	(Gelfand et al., 1985)
Asteraceae	*Helichrysum caespititium (DC.) Harv*	Perennial herb		Whole plant	Sexually transmitted diseases and gonorrhea	Respiratory infections, sexually transmitted infections, nausea, headache, wounds, ulceration, and used as an aphrodisiac	C, E	(Maroyi, 2019b)
Malvaceae	*Hibiscus cannabinus L.*	Annual, usually unbranched, herb to 2 m.	Decan hemp (English) Kenaf (English) Sosoori (Shona) Wild stockrose (English)	Leaves: Inserted into vagina	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Constipation and dilated veins around umbilicus.	N, E, W, S, C	(Gelfand et al., 1985)

Apocynaceae	*Holarrhena pubescens (Buch-Ham.) Wall*	Tree, shrub over 2 m.	Chigafusi (Shona) Fever-pod (English) Jasmine-tree (English) Mugashu (Shona) Muhatsu (Shona) Mukashumukono (Shona) Mukashumurume (Shona)	Root: Infusion taken orally.	Venereal diseases	Aphrodisiac, infertility, asthma, to increase blood in the body and cause abortion.	N, E, W, S, C	(Gelfand et al., 1985)
Hydnoraceae	*Hydnora abyssinica A. Braun ex Schweinf.*	A subterranean root parasite, lacking chlorophyll.	No information	Swollen underground stem: It is ground into powder and taken orally	Kidney and bladder complaints.	To prevent a miscarriage, measles, antidote for poison and diarrhoea with blood.	W, C	(Gelfand et al., 1985)
Poaceae	*Hyparrhenia filipendula (Hochst.) Stapf*			Roots: Decoction	Syphilis	Depressed fontanelle, and chronic illnesses	N, E, W, S, C	(Gelfand et al., 1985)
Hypoxidaceae	*Hypoxis hemerocallidea Fisch., C.A. Mey. & Avé-Lall.*	Robust perennial herb	Hodo (Shona) Igudu (Ndebele) Yellow star, African potato (English)	Tuber	Urinary infections		W, E	(Viol, 2009)
Hypoxidaceae	*Hypoxis obtuse Burch*			Tuber: Tuber ground into powder and added to porridge	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Aphrodisiac, infertility in women, abdominal pains, heart pains and bile emesis.	N, E, W, S, C	(Gelfand et al., 1985)
Fabaceae	*Indigofera arrecta A. Rich.*	Shrub over 2 m, shrub under 2 m.	African indigo (English)	Root: Infusion	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Diuretic, purgative, abdominal pains, infertility, dysmenorrhoea, convulsions, to prevent sore eyes and abortion.	N, E, W, S, C	(Gelfand et al., 1985)
Asteraceae	*Inula glomerata Oliv. & Hiern*	Robust perennial herb	Hare's ears (English) Zeveratsuro (Shona) Zheveratsuro (Shona)	Root: Infusion taken orally.	Venereal diseases	Constipation, abdominal pains centred on the umbilicus, infertility in women, tonic for premature babies, to dilate the birth canal, pneumonia and earache.	N, E, W, S, C	(Gelfand et al., 1985)

Meliaceae	*Khaya anthotheca (Welw.) C. DC.*	Tree	Mubarwa (Shona) Mururu (Shona) Muwawa (Shona) Red mahogany (English)	Bark: infusion	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) and venereal diseases	Aphrodisiac, pneumonia, abdominal pains and antiemetic.	N, C, E	(Gelfand et al., 1985; Viol, 2009)
Bignoniaceae	*Kigelia africana (K. pinnata)*	Tree	Mubvee, Musonya, Muvhumati (Shona) Sausage tree (English) Umvebe (Ndebele)	Fruits Roots	Venereal diseases and syphilis Swelling of genitalia	No information	N, E, W, S, C	(Viol, 2009; Marekerah, 2015)
Asteraceae	*Inula glomerata Oliv. & Hiern*	Robust perennial herb	Hare's ears (English) Zeveratsuro (Shona) Zheveratsuro (Shona)	Root: Infusion taken orally.	Venereal diseases	Constipation, abdominal pains centred on the umbilicus, infertility in women, tonic for premature babies, to dilate the birth canal, pneumonia and earache.	N, E, W, S, C	(Gelfand et al., 1985)
Anacardiaceae	*Lannea discolor (Sond.) Engl*	Tree	Chizhenje (Shona) Live-long (English) Mugan'acha (Shona) Muhumbukumbu (Shona) Mumbumbu (Shona) Mupuri (Shona) Mushamba (Shona) Tree grape (English)	Roots: infusion from fresh or dried part of roots	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) and STD.	Convulsions, diarrhoea, fractures, wounds, infertility in women, swollen legs, sore eyes, whooping cough, and heavy menstruation.	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2018b; Kambizi and Afolayan, 2001)
Anacardiaceae	*Lannea edulis (Sond.) Engl.*	Shrub	Mutsambatsi, Musambasi (Shona) Intakubomvu (Ndebele) Mutsambatsi (Shona) Tsombori (English) Wild grape (English	Leaves and roots: infusion from fresh or dried part of roots Root: Infusion. Cooked with seeds of Vigna unguiculata and the soup is taken by mouth.	Gonorrhea, blood in urine, syphilis, and other venereal disease	Diarrhoea, bronchitis, inflammation of the umbilical cord, abdominal pains, bronchitis, cough, dizziness, dysmenorrhea, to avoid abortion and bilharziasis.	N, E, W, S, C	(Gelfand et al., 1985; Kambizi and Afolayan, 2001; Chigora et al., 2007; Maroyi, 2011, 2013a, 2019c)
Solanaceae	*Solanum lycopersicum L*	Sprawling or sub-erect short-lived herb	Tomato (English)	Root: Mixed with roots of Capsicum spp. and infusion taken orally.	Blood in urine.	Earache and epilepsy.	Cultivated	(Gelfand et al., 1985)

Anacardiaceae	*Mangifera indica*	Tree	Mumango (Shona) Mango (English)	Leaves	Gonorrhoea	Astringent, asthma, anthelmintic, prolongs ejaculation.	C, E	(Mangoyi et al. ,2014)
Euphorbiaceae	*Manihot esculenta Crantz*	Tree	No information	No information	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	No information	N, C	(Gelfand et al., 1985)
Meliaceae	*Melia azedarach L.*	Tree	Persian lilac (English) Syringa (English) Syringa berry (English)	Leaves: Decoction taken orally	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Abdominal pains, bile emesis and depressed fontanelle.	N, E, W, S, C	(Gelfand et al., 1985)
Dipterocarpaceae	*Monotes glaber Sprague*	Tree	Inyunya (Ndebele) Muaraara (Shona) Mubaravashava (Shona) Murasha (Shona) Pale-fruited monotes (English)	Root: decoction taken orally.	Blood in urine (Haematuria)	Infertility in men, to control excessive vaginal secretion, heart pains, toothache and aphrodisiac.	N, W, C, S	(Gelfand et al., 1985)
Musaceae	*Musa spp.*			Root: Root infusion taken orally	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Heart pains	Cultivated	(Gelfand et al., 1985)
Apocynaceae	*Nerium oleander L.*	Tree, shrub over 2 m.	Oleander (English)	Leaves: Infusion taken orally. Whole plant: taken orally.	Venereal diseases	No information	Cultivated	(Gelfand et al., 1985)
Olacaeceae	*Olax dissitiflora Oliv.*	Tree, shrub over 2 m.	Chikwakwani (Shona) Kamasa (Shona) Small-fruited olax (English)	Root: Root ground into powder and mixed with water or porridge.	Venereal diseases	Aphrodisiac	N, E, W, S, C	(Gelfand et al., 1985)
Anacardiaceae	*Ozoroa reticulata (Baker f.) R. Fern. & A. Fern.*	Tree	Mubhedha Tropical resin tree, currant resin tree (English).	Root or bark: Infusion	Venereal diseases/ STIs	Abdominal pains, diarrhoea, constipation, inflammation of navel cord, bilharziasis, painful uterus, backache, body weakness, menorrhagia and aphrodisiac.	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2013a)

Apocynaceae	*Pachycarpus bisacculatus (Oliv.) Goyder*	Perennial herb	No information	Tuberous root: Infusion taken orally.	Venereal diseases	Aphrodisiac and abdominal pains.	N, W, C, E	(Gelfand et al., 1985)
Chrysobalanaceae	*Parinari curatellifolia Planch, ex Benth*	Tree	Hissing tree (English) Mobola plum (English) Mubuni (Shona) Muchakata (Shona) Muhacha (Shona) Muisha (Shona) Umkhuna (Ndebele)	Bark, root and leaves	Herpes zoster and herpes simplex	Skin rashes, tuberculosis and chronic diarrhoea.	N, E, W, S, C	(Chimponda and Mukanganyama, 2010; Mangoyi et al., 2014)
Rubiacaeae	*Pavetta schumanniana F. Hoffm.*	Shrub or small semi-deciduous tree.	Chifukawi (Shona) Chinama (Shona) Chipindura chiduku (Shona) Chitunguru (Shona) Chityorabadza (Shona) Mufuramhembwe (Shona) Murambagaka (Shona) Murunganyama (Shona) Musauti (Shona) Muwana (Shona) Mwenje (Shona) Nyapuna (Shona) Nyaputa (Shona) Poison bride's-bush (English) Poison pavetta (English) Umbodzani (Ndebele)	Root: Infusion taken orally.	Venereal diseases	Cough, abdominal pains, diarrhoea, nausea, headache, pneumonia, chest pains, aphrodisiac and infertility in women.	N, E, W, S, C	(Gelfand et al., 1985)
Fabaceae	*Peltophorum africanum Sond.*	Tree, shrub over 2 m.	African wattle (English) Dzedze (Shona) Mudjiza (Shona) Mupumhamauva (Shona) Musambanyoka (Shona) Mutandarombo (Shona) Muzeze (Shona) Nyakambariro (Shona) Nyamanyoka (Shona) Umkahla (Ndebele) Umsehla (Ndebele) Zeze (Shona)	Root: Infusion Bark, leaves or root: extract drunk	Venereal diseases Syphilis	Abdominal pains, swollen stomach, diarrhoea, nausea, diuretic, sores on throat, toothache remedy for all diseases and chest pains.	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2011, 2013a; Maroyi and Cheikhyoussef, 2015)
Poaceae	*Phragmites Mauritianus Kunth*	Robust perennial with long rhizomes.	Tsanga (Shona) Reed grass (English)	Leaves: rub sharp ends of leaves on wounds	STD	No information	N, E, W, S, C	

		(Grass)						
Celastraceae	*Pleurostyylia africana Loes.*	Tree	Mulyamandebele (Tonga: Zimbabwe) Northern coffee-pear (English)	Root: Infusion taken orally.	Venereal diseases	Bilharziasis and infertility.	N, E, W, S, C	(Gelfand et al., 1985)
Polygalaceae	*Polygala gazensis Bak. f.*	Ericoid shrub or subshrub, up to 2 m, sometimes sprawling.	No information	Root: Infusion taken orally.	Venereal diseases	Abdominal pains.	E, S	(Gelfand et al., 1985)
Polygonaceae	*Persicaria decipiens (R. Br.) K.L. Wilson*	Slender erect or decumbent perennial herb.	Snake-root (English)	Root: Wash penile sores with infusion.	Syphilis	Aphrodisiac	N, E, W, S, C	(Gelfand et al., 1985)
Urticaceae	*Pouzolzia mixta Solms*	Large, many-stemmed shrub or small tree.	Isikhukhukhu (Ndebele) Munanzva (Shona) Snuggle-leaf (English) Soap nettle (English) Tasva (Shona)	Roots: extract drunk as medicine. Root: Infusion of the root	STI Venereal diseases	Aphrodisiac, depressed fontanelle, burns, infertility in women, to prevent conception, open wounds, retained placenta, constipation, to prevent abortion and to dilate birth canal	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2011, 2013a)
Euphorbiaceae	*Pseudolachnostylis maprouneifolia Pax*	Tree	Duiker-berry (English) Kudu-berry (English) Mudyamhembwe (Shona) Mukuvazviyo (Shona) Mutsonzowa (Shona) Umqobampunzi (Ndebele)	Root: Infusion	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Abdominal, nausea, convulsions, aphrodisiac, headache, infertility in women, wounds, body weakness, dizziness, fever and body weakness.	N, E, W, S, C	(Gelfand et al., 1985)
Clusiaceae	*Psorospermum febrifugum Spach*	Tree, shrub over 2 m.	Christmas berry (English) Mumhinu (Shona) Munyamharadzi (Shona) Muparadzamusha (Shona) Musvasva (Shona) Umchithamuzi (Ndebele)	Root: Infusion taken orally and ashes applied to penile wounds	Syphilis	Head wounds, diarrhoea, pneumonia, earache, shortness of breath and constipation.	N, C, E, S	(Gelfand et al., 1985)

Fabaceae	*Pterocarpus angolensis DC*	Medium to large deciduous tree	Bloodwood (English) Mubvamakovo (Shona) Mubvamaropa (Shona) Mubvinziropa (Shona) Mukambira (Shona) Mukonambiti (Shona) Mukula (Tonga: Zimbabwe) Mukurambira (Shona) Mukwa (English) Mukwa (Shona) Mukwirambira (Shona) Mushambaropa (Shona) Muzwamulowa (Tonga: Zimbabwe) Umvagazi (Ndebele)	Fruits: Burnt and ashes mixed with water Bark: Infusion	Venereal diseases and blood in urine (Haematuria)	Diarrhoea with blood in stool, diarrhoea, backache, heavy menstruation, bilharziasis, abdominal pains, cataract, ringworm, generalised body pain, prevent illness, ulcers, asthma, tuberculosis, depressed fontanelle, head wounds and severe lameness.	N, E, W, S, C	(Gelfand et al., 1985)
Euphorbiaceae	*Ricinus communis L.*	Tree, annual, perennial, shrub over 2 m, shrub under 2 m.	Castor-oil plant (English)	Root: Powder mixed with juice from fruit of Solanum spp. and mixture is rubbed on penile sore	Syphilis	Earache, diarrhoea, cataracts, sore eyes, toothache, pneumonia, abdominal, measles, hiccoughs, bilharziasis, heart pains, palpitations, constipation and madness.	N, E, W, S, C	(Gelfand et al., 1985)
Asparagaceae	*Sansevieria hyacinthoides (L.) Druce*	Herb	Masavamhanda (shona), Mother-in-law's tongue, Piles root, Bowstring hemp (English)	Leaves, rhizomes, and root	Sexually transmitted infections (genital warts, gonorrhoea, syphilis, and venereal diseases)	No information	N, C, E, S	(Takawira-Nyenya and Stedje, 2011; Maroyi, 2013a, 2019d)
Asteraceae	*Schkuhria pinnata (Lam) Thell*	Delicate, branched annual herb.	Dwarf marigold (English) Ruhwahwa (Shona)	Leaves: Infusion taken orally.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Abdominal pains, diarrhoea and to prevent conception.	N, E, W, S, C	(Gelfand et al., 1985)
Anacardiaceae	*Searsia chirindensis (Baker f.) Moffett*	Shrub or small tree.	Mubikasadza (Shona) Mutsodzo (Shona) Red currant rhus (English)	Leaves and roots	Syphilis	Measles, cough and chest pains	W, C, E, S	(Viol, 2009)
Anacardiaceae	*Searsia longipes (Engl.) Moffett var. longipes*	Tree, shrub over 2 m.	Inhlokotshiyane (Ndebele) Large-leaved rhus (English) Mudzambuya (Shona) Mufokosiana (Shona)	Root: Infusion taken orally.	Syphilis	Abdominal pain, diarrhoea, cough, to dilate the birth canal, infertility and aphrodisiac in women.	N, C, E	(Gelfand et al., 1985)

			Mutungahove (Shona)					
Polygalaceae	*Securidaca longipedunculata Fresen.*	Deciduous shrub or small tree.	Chipvufanana (Shona) Mufufu (Shona) Munyapunyapu (Shona) Munyazvirombo (Shona) Mutangeni (Shona) Umfufu (Ndebele) Violet tree (English)	Root: Infusion taken orally.	Syphilis and venereal diseases	Epilepsy, convulsions, snake bites, bile emesis, diarrhoea, chronic illness, abdominal pains, constipation, aphrodisiac, to prevent abortion, cataracts, tropical ulcers, fever, tuberculosis, pneumonia, stomach pains, palpitations, infertility in women, tonic for babies and pains during pregnancy.	N, E, W, S, C	(Gelfand et al., 1985; Viol, 2009)
Asteraceae	*Senecio latifolius DC.*	Erect herb	Noxious ragwort (English)	Root: Infusion taken orally.	Venereal diseases	Dizziness, painful uterus, constipation, earache, tonic for infants and abdominal pains.	C, E, S	(Gelfand et al., 1985)
Solanaceae	*Solanum campylacanthum 'incanum type'*	Shrub	Bitter apple (English) Intume (Ndebele) Munhomboro (Shona) Munhundurwa (Shona) Poison apple (English) Snake apple (English) Sodom apple (English) Thorn apple (English) Umdulukwa (Ndebele)	Root: Powder mixed with porridge and powder can be applied to incisions on swollen glands. Root infusion or decoction is taken orally. Fruit: cut the fruit and juice or sap applied on affected parts	Venereal diseases	Dysmenorrhoea, sore eyes, constipation, diarrhoea, antiemetic, headache, pneumonia, wasting away in infants, tropical ulcers, general body pains, depressed fontanelle, sore throat, toothaches, swelling of the body, snake bite and ringworm.	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2013a; Kambizi and Afolayan, 2001)
Malpighiaceae	*Sphedamnocarpus pruriens (A. Juss) Szyszyl.*	Herbaceous or woody twiner or scrambler, sometimes trailing.	Canary nettle (English) Lesser moth-fruit creeper (English)	Root: Infusion taken orally.	Syphilis	Abdominal pains in infants, infertility in women and aphrodisiac.	N, W, E, S	(Gelfand et al., 1985)

Euphorbiaceae	*Spirostachys africana Sond.*	Tree	Munhiti (Shona) Mutivoti (Shona) Mutomboti (Shona) Mutsomvori (Shona) Mutuvuti (Shona) Tamboti (English) Ubande (Ndebele) Umthombothi (Ndebele)	Roots: root powder mixed with porridge as remedy	Venereal infections	No information	E, S	(Maroyi, 2013a; Chigora et al., 2007)
Apiaceae	*Steganotaenia araliacea Hochst. var. araliacea*	Shrub or small tree	Carrot-tree (English) Mubanda (Shona) Mugodorapfuti (Shona) Mupomboboshori (Shona) Mupombohorore (Shona) Mupombotyori (Shona) Mupuku (Shona) Mushoriondo (Shona) Musvodzambudzi (Shona) Umbhojana (Ndebele)	Root: Infusion taken orally. Bark, young leaves and stem.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) STI infections	Abdominal pains, infertility in women, general body weakness, chronic illness, palpitations, cessation of menses, sore eyes and epilepsy.	N, E, W, S, C	(Gelfand, 1956; Gelfand et al., 1985; Matowa et al., 2020)
Loganiaceae	*Strychnos cocculoides Bak.*	Tree	Corky monkey-orange (English) Muhumi (Shona) Mushumwi (Shona) Mutamba muzhinyu (Shona)	Root: Infusion taken by mouth.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Abdominal pains, diarrhoea, infertility, painful uterus, cessation, to prevent miscarriages, hydrocele, sore throat, sore eyes and emetic.	N, W, C, S	(Gelfand et al., 1985; Maroyi, 2011, 2013a; Maroyi and Cheikhyoussef, 2015)
Loganiacaea	*Strychnos spinosa Lam.*	Shrub or small deciduous tree.	Mutamba-mun'ono (Shona) Spiny monkey-orange (English) Umhahli (Ndebele) Umngono (Ndebele)	Root: Infusion taken orally Roots: crushed hot extract drunk as remedy Fruits: extract drunk as remedy	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) and genital warts.	Abdominal pains, diarrhoea, infertility, painful uterus, cessation, to prevent miscarriages, hydrocele, sore throat, sore eyes and emetic.	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2011, 2013a, Chigora et al., 2007)
Fabaceae	*Swartzia madagascariensis (Desv.) J.H. Kirkbr. & Wiersama*	Tree, shrub over 2 m.	Mucherekese (Shona) Snake bean (English)	Bark Pod: Ground into powder and applied on penile sores.	Venereal diseases Syphilis	Diarrhoea, abdominal pains, headache, wounds, earache, emetic, infertility in women, cataracts and swelling on the body.	N, E, W, S, C	(Constance et al, 2019, Gelfand, 1956; Gelfand et al., 1985)

Myrtaceae	*Syzygium cordatum Hochst. ex C. Krauss*	Tree	Gihlu (Hlengwe) Imiswi (Ndebele) Muisu (Shona) Mukute (Shona) Munonyamansi (Tonga: Zimbabwe) Umdoni (Ndebele) Waterberry (English)	Leaves and bark	Herpes zoster, herpes simplex	Skin rashes, cold and fever.	N, E, W, S, C	(Chigora et al., 2007; Wyk, 2011; Maroyi, 2013; Mangoyi et al., 2014)
Fabaceae	*Tamarindus indica L.*	Medium to large evergreen tree.	Musika (Shona) Tamarind (English)	Fruit: Infusion	Venereal diseases	Sore throat	N, W, E	(Gelfand et al., 1985)
Combretaceae	*Terminalia brachstemma Welw. ex Hiern*	Shrub or small semi-deciduous tree.	Kalahari cluster-leaf (English)	No information	Blood in urine	Bilious vomiting, constipation and diarrhoea.	N, W, C	(Gelfand et al., 1985)
Combretaceae	*Terminalia sericea Burch. ex DC*	Small to medium-sized deciduous tree.	Mangwe (Shona) Mukonono (Shona) Mususu (Shona) Mutabvu (Shona) Silver cluster-leaf (English) Silver terminalia (English) Umangwe (Ndebele)	Root: Infusion Root: Decoction taken orally.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin) Gonorrhoea, syphilis and other STD Venereal diseases	Wounds, diarrhoea, abdominal pains, worms in anus, antiemetic, infertility in women, to dilate the birth canal, to prevent an abortion, tonic, general body weakness, depressed fontanelle, sore throat, bilharziasis	N, E, W, S, C	(Chinemana et al., 1985; Gelfand et al., 1985; Rodgers and Verotta, 1996; Viol, 2009; Mongalo et al., 2016)
Meliaceae	*Toona ciliata M. Roem.*	Tree	Cedrela (English) Red cedar (English) Toon tree (English)	Leaves: Infusion	Venereal diseases	No information	N, C	(Gelfand et al.,1985)
Boraginaceae	*Trichodesma ambacense Welw. subsp. hockii (DeWild) Brummitt*	Perennial herb	Blue Bells of St Mary's (English) Gwiramwaka (Shona)	Tuber: applied to incision made on swollen glands.	Syphilis	Backache, swelling on the body, depressed fontanelle, to dilate the birth canal, bilharziasis, headache, madness and madness.	N, W, C, E	(Gelfand et al.,1985)

Malvaceae	*Triumfetta welwitschii Mast.*	Perennial herb	No information	Tuber: decoction taken orally.	Venereal diseases	Diarrhoea, abdominal pains, aphrodisiac, depressed fontanelle, painful uterus, to prevent abortion, asthma, fever, dysmenorrhea, generalised body pains, antidote, to increase blood in body	N, E, W, S, C	(Gelfand et al., 1985)
Meliaceae	*Turrea nilotica Kotschy & Peyr.*	Tree, shrub over 2 m.	Bushveld honeysuckle-tree (English) Chipindura (Shona) Chirambagavakava (Shona) Chitsvimbovarisa (Shona) Isidlamvundala (Ndebele) Miombo honeysuckle-tree (English) Mudyakuwe (Shona) Small mahogany (English)	Root; infusion taken orally	Venereal diseases	Abdominal pains, constipation, epilepsy, inflammation of umbilical cord, dysmenorrhoea, dizziness, diarrhoea, pneumonia, headache, sore eyes, shortness of breath, madness, depressed fontanelle, antidote for poison and snake bite.	N, E, W, S, C	(Gelfand et al.,1985)
Rubiaceae	*Vangueria infausta Burch.*	Tree	Mudzvirungombe False medlar, velvet wild medlar (English), umthofu, umviyo (Ndebele), mudzvirungombe, munjiro, munzviro, munzirwa, munzvirwa, mutsviru (Shona)	Root: Decoction applied topically. Infusion taken orally	Virginal discharge.	Abdominal pains, diarrhoea, dysmenorrhea and inflammation of naval cord.	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, and Cheikhyoussef, 2015; Maroyi, 2011, 2013a, 2018c)
Asteraceae	*Vernonia amygdalina Del.*	Tree, shrub over 2 m	Dembezeko, Musikavakadzi, Muzhozho, Nyareru (Shona) Tree Vernonia, Bitter-tea vernonia (English) Inyathelo (Ndebele)	Roots: chopped roots, infusion	STD, Venereal diseases	Painful uterus, infertility in women, abdominal pains, cessation of menses, aphrodisiac, cough, weak joints, bilharziasis, fever, diarrhoea and swelling on the body.	N, E, W, S, C	(Gelfand et al.,1985; Kambizi and Afolayan, 2001)

Asteraceae	*Vernonia colorata*	Tree, shrub over 2 m.	Musikavakadzi, Rurimirwemombe (Shona) Star-flowered bitter-tea, Lowveld tree vernonia (English)	No information	Venereal diseases		N, E, W, S, C	(Gelfand et al., 1985)
Astercaeae	*Vernonia glaberrima O. Hoffm.*	Small shrub	Nyakashwa (Shona)	Root: Powder mixed with porridge.	Venereal diseases	Swollen stomach, dysmenorrhea, and depressed fontanelle.	C, E	(Gelfand et al., 1985)
Asteraceae	*Vernonia glabra (Steetz) Vatke*	Perennial herb		Root: Infusion taken orally.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Abdominal pain, red eyes, to cause abortion, burns and infertility in women	N, C, S	(Gelfand et al., 1985)
Verbenaceae	*Vitex payos (Lour.) Merr*	Tree, shrub over 2 m.	Chikubai (Shona) Chikubvusike (Shona) Chocolate berry (English) Mudyagava (Shona) Muhubva (Shona) Muhubvu (Shona) Mukubvu (Shona) Mutsere (Shona) Mutsubvu (Shona) Umtshwankela (Ndebele)	Root: Porridge prepared with infusion and taken orally.	Gonorrhoea (an inflammatory discharge from the urethra or vagina of venereal origin)	Cough and to prevent abortion.	N, E, W, S, C	(Gelfand et al., 1985)
Canellaceae	*Warburgia salutaris (Bertol. f.) Chiov.*	Tree	[Muranga (Shona) Pepper-bark tree (English) Isibhaha (Ndebele)	Bark: Powdered bark used as infusion or decoction Bark: Decoction or powder mixed in porridge. Stem, bark and roots.	Venereal diseases (STDs).	Abdominal pains, headache, to increase blood in the body, to cause abortion and remedy for all diseases.	E	(Gelfand et al., 1985; Maroyi, 2013b; Viol, 2009; Shumba et al., 2009)
Canellaceae	*Warburgia sulcata*	No information	No information	No information	STD	No information	No information	(Mapfumo and Mtindi, 1995)
Fabaceae	*Xeroderris stuhlmannii (Taub.) Mendonca & E.P. Sousa*	Tree	Muchemavanhu (Shona) Mudzugu (Shona) Mumwambizi (Shona) Muriravanhu (Shona) Murumanyama (Shona) Umthundulu (Ndebele) Wing pod (English)	No information	Venereal diseases	No information	N, E, W, S, C	(Chinemana et al.,1985)

Olacaceae	*Ximenia caffra* Sond	Tree, shrub over 2 m.	Munhengeni (Shona) Mutengeni (Shona) Mutsvanzva (Shona) Sourplum (English) Umthunduluka (Ndebele)	Root: root infusion taken by mouth Leaves, roots Root, fruits and seeds.	STD and venereal diseases STI	Aphrodisiac, pelvic disease in women, abdominal pains, wounds, diarrhoea, infertility, biharziasis, fever and sore eyes.	N, E, W, S, C	(Gelfand et al., 1985; Kambizi and Afolayan, 2001; Maroyi and Cheikhyoussef, 2015; Maroyi, 2011, 2013a; Matowa et al., 2020)
Sapindaceae	*Zanha africana* (Radlk) Excell.	Tree, shrub over 2 m	Muchenya (Shona) Velvet-fruit zanha (English)	Bark: infusion from fresh or dried part of bark	STD		N, E, W, S, C	(Kambizi and Afolayan, 2001; Maroyi, 2019e)
Rhamnaceae	*Ziziphus mucronata* Willd	Small to medium-sized tree	Buffalo-thorn (English) Chinanga (Shona) Muchecheni (Shona) Umpasamala (Ndebele) Umphafa (Ndebele)	Root: Infusion	Venereal diseases and bladder infections.	Boil, abdominal pains, bile emesis, bilharziasis, infertility in women, to prevent abortion, pneumonia, weak bladder, snake bite, depressed fontanelle, wounds, dysmenorrhoea, remedy for all disease and swelling of the body.	N, E, W, S, C	(Gelfand et al., 1985; Maroyi, 2011, 2013a; Maroyi and Cheikhyoussef, 2015; Adebayo and Masoko 2019; Mongalo et al., 2020)
Fabaceae	*Zornia glochidiata* C. Rchb. ex DC.	Perennial or decumbent annual herb		Root: Ground into powder and mixed with porridge.	Venereal diseases	To dilate birth canal and to prevent abortion.	N, E, W, S, C	(Gelfand et al., 1985)

Geographical Distribution of Medicinal Plants Used for Treating and Managing Genitourinary Infections in Zimbabwe

Zimbabwe is typically classified into five distinct ecological zones, delineated by variations in rainfall patterns and intensity. A general depiction of the distribution of different floristic regions of Zimbabwe is displayed in Figure 4 showing N - North, W- West, C - Central, E - East and S – South flouristic regions of the country.

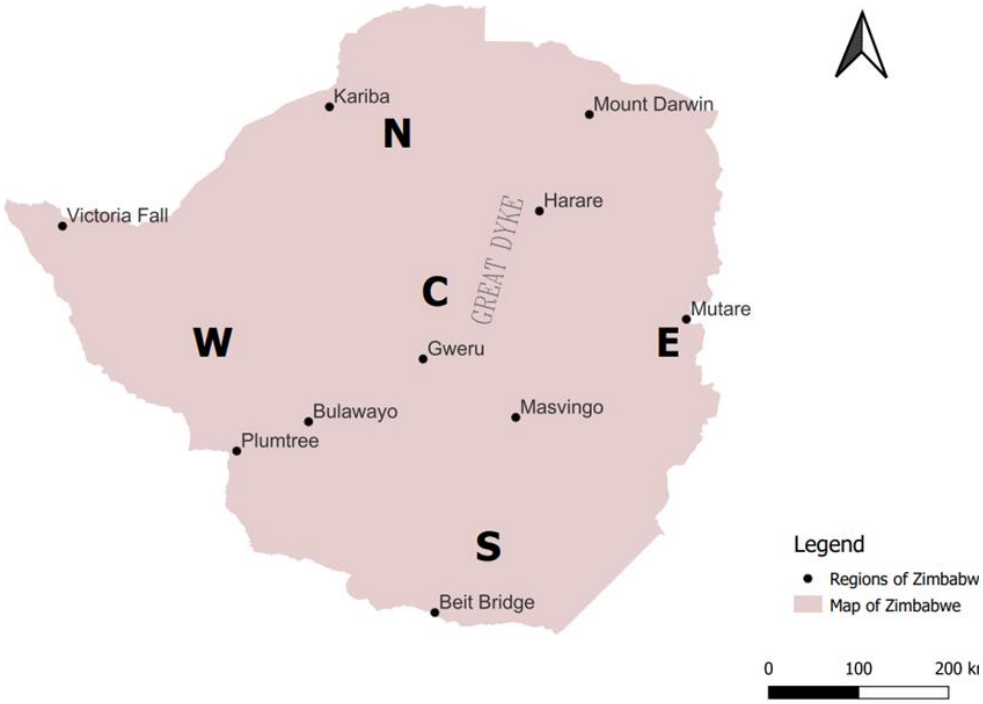

Figure 4. Geographical distribution of medicinal Flora in Zimbabwe's distinct Floristic regions

Approximately 69% of the plants highlighted in this review demonstrate extensive distribution across Zimbabwe', whereas the species W. salutaris, which constitutes 1%, is restricted solely to the Eastern region of Zimbabwe. Based on the Red Data List, W. salutaris is classified as critically endangered and its distribution is limited to the Tanganda Tea Estates and a few surrounding locations (Hyde et al., 2023). Additionally, 4% of herbal plants are cultivated. No information was reported on the W. sulcata plant species probably rendering its extinction.

Growth Characteristics and Utilised Plant Parts of Medicinal Species for Managing Genitourinary Infections in Zimbabwe

Trees com included medium to large deciduous trees; medium to large evergreen trees, small deciduous trees and small to medium sized trees. Herbs incoporated included erect perennial herbs; delicate, branched annual herbs; annual, usually unbranched, herbs which grow up to 2 m; perennial or decumbent annual herb; robust perennial herbs; stemless succulent perennial herbs; sprawling or sub-erect short-lived herbs; erect, usually dichotomously branched annual or short-lived perennial herbs. Grass and mistletoe included robust perennial with long rhizomes and subterranean root parasite, lacking chlorophyll respectively. Shrubs with the extension of scrambling shrubs; succulent perennials, sometimes large and shrub-like; ericoid shrub or subshrub, growing up to 2 m, sometimes sprawling and dwarf shrub with annual stems, typically less than 30 cm, growing from a woody rootstock. Climber or liane covering herbaceous or woody twiner or scrambler, sometimes trailing.

Out of the 119 medicinal plant species documented, the majority are trees (49%), followed by shrubs (13%), herbs (17%), shrub or small trees (9%), and climbers (3%). Additionally, plant forms such as bub globose, grass, mistletoe, and single seamless plants constituted 1% each. Furthermore, 5% of the reviewed plants lack information regarding their growth forms. According to Maroyi (2013a), there has been a reported prevalence of using trees and shrubs as medicinal remedies in Zimbabwe, and the Fabaceae family was

found to be the most commonly represented. The plant parts commonly used include roots (61.2%), followed by stem bark (10.9%), leaves (10.2%), fruit (6.8%), tuber (5.4%), whole plant (2%), stem (2%), and pods, seeds, rhizomes, and bulbs (0.7%) (Figure 5). The roots were the most commonly used plant parts in the production of polyherbal formulations from Table 1, which are then taken in as infusions (Van Vuuren et al., 2022). Combination's therapy using the roots is nonconservative as it goes against the sustainable use of natural resources. This is due to the fact that obtaining the roots normally results in physiological damage to the whole plant. Many important secondary metabolites may be present in the dominant plant parts that are used, which could explain the selection of the plant part. However, it is crucial to note that the utilization of plant roots and bark is discouraged due to the harmful impact it has on the plant. This has led to the extinction or depletion of medicinal plants around the world. Therefore, it is imperative to ensure that such practices are conducted sustainably.

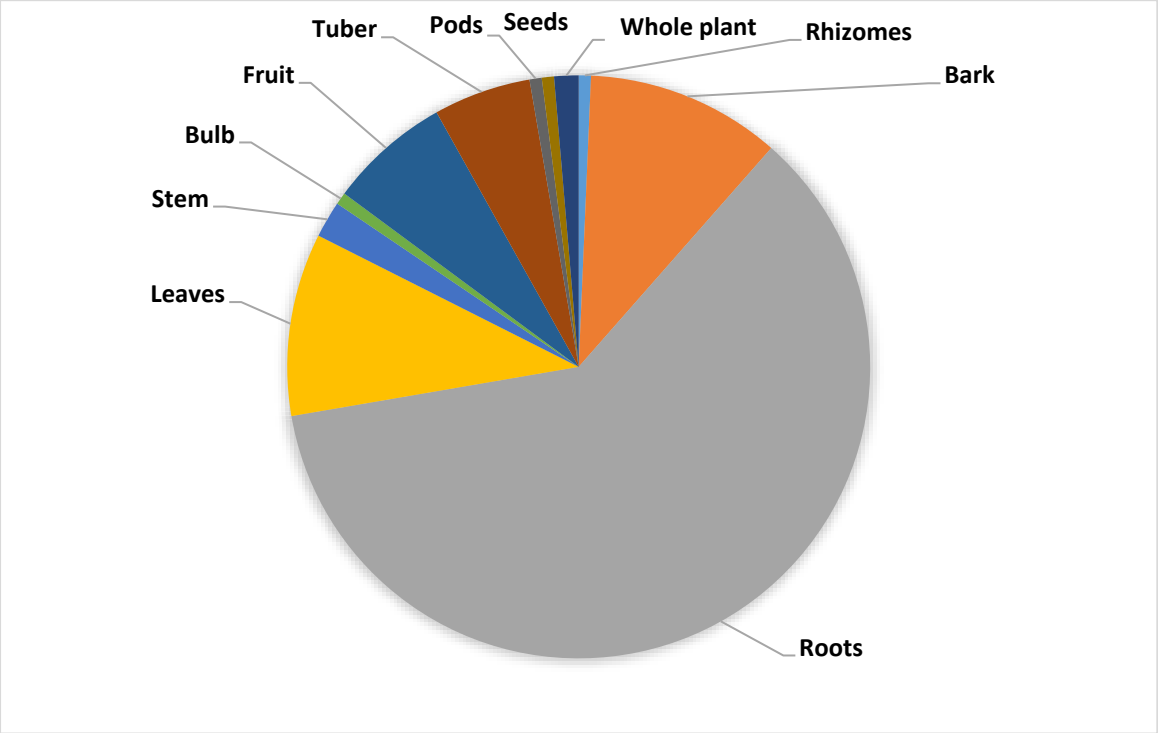

Figure 5. Plant parts utilised in medicinal species for treating and managing genitourinary infections in Zimbabwe

Mode of Preparation and Administration/Application of Medicinal Plants Utilised for the Treatment and Management of Genitourinary Infections in Zimbabwe

The majority of the plant species (72%) are administered as infusions. It is important to note that the infusions are prepared using water as a solvent. Following infusions, the second most prevalent method of administration is through powders (15%), followed by decoctions (9%), ashes (3%), and juice/sap (1%). It is important to acknowledge that in traditional medicine, a common practice involves combining multiple plants and administered until the infection is healed. The belief is that concoctions of various herbs enhance the potency of the individual herbs, thereby expediting the healing process. Infusions are simple to prepare, because water is an easily accessible solvent. The most prevalent method of administering the formulations was oral, as infusions were prepared.

The primary mode of administration for the plant species is oral ingestion, accounting for 74% of cases, followed by topical application at 23%. Additionally, 3% of the reviewed plants are inserted into the vagina. Oral consumption of the therapeutic components is vital because most infections have a higher influence on internal organs. (Chaachouay et al., 2020). Oral administration of therapeutic medicines is a

more common cultural practice in Africa. (Benarba et al., 2014; Chermat and Gharzouli, 2015). Topical application also involves applying the herbal remedies directly to affected areas, such as penile sores, incisions on swollen glands, and the genital area. It also includes using infusions to wash external genital sores.

Genitourinary Infections (GUIs) Conditions Treated And Managed by Medicinal Plants Found in Zimbabwe and Other Ethnomedicinal Uses

Our study reveals that herbal medicines are utilised in Zimbabwe for the treatment of various STIs, with focus on unspecified STIs/STDs/venereal diseases, gonorrhoea, and syphilis with significant propotions. The largest proportion, accounting for 43% of cases, comprised unspecified STIs/STDs/venereal diseases. This suggests that herbal remedies are frequently employed for treating STIs that are not specifically identified or categorized. Gonorrhoea, a common STI, constituted 24% of the cases where herbal medicines were Utilised for treatment. Syphilis accounted for 20% of the cases. Furthermore, our results revealed that herbal remedies were used to address various other STIs and related conditions, albeit to a lesser extent. These included blood in urine (4%), bladder infections/problems (3%), swelling of genitalia (1%), kidney pains (1%), vaginal discharge (1%), urinary infections (1%), genital warts (1%), and herpes zoster and herpes simplex (1%) (Figure 6). Various bacteria, parasites, and fungi, including N. gonorrhoea, Mycoplasma hominis, Mycoplasma genitallium, Chlamydia trachomatis, and Klebsiella granulomatis, as well as viruses like Cytomegalovirus, HSV type-2, HSV-8, Hepatitis B, and human immunodeficiency virus, can cause these infections (Mongalo and Raletena, 2022).

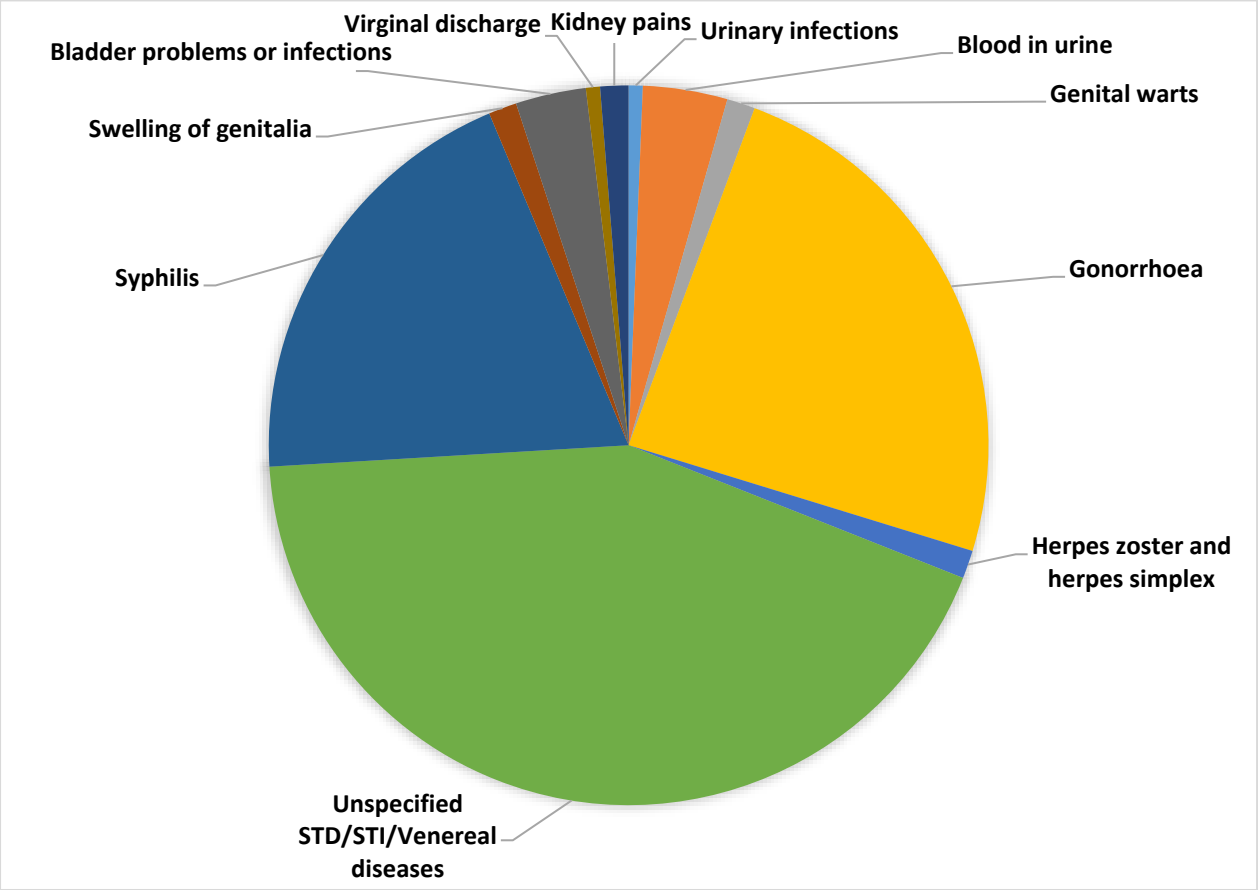

Figure 6. Genitourinary infections (GUIs) addressed by medicinal plants indigenous to Zimbabwe

The findings of this review underscore the need for further research and exploration of herbal remedies as potential alternatives in managing STIs, particularly for unspecified cases, gonorrhoea, and syphilis. The results contribute to the growing body of knowledge on traditional medicine and its role in addressing the healthcare challenges posed by STIs.

Pharmacological Efficacy of Medicinal Plants Utilized for the Management of Genitourinary Infections in Zimbabwe

Due to medicinal plants ability to treat and manage medical conditions, studies on herbal medications are becoming more and more popular (Rajamurugan et al., 2012; Halder et al., 2021). Pharmacological studies have been conducted on several identified medicinal plants with at least 82.4% being scientifically validated. However, the majority of the plants have not been assessed for their potency against GUIs. Table 3 gives an insight into the plant species with their toxicological and pharmacological aspects. For genitourinary infections, the major pharmacological properties to expect are antibacterial, antifungal, antimicrobial and antiviral. Anti-inflammatory effective drugs are needed to prevent the continuation of some STIs (Moghadam et al., 2021). Chronic inflammation caused by sexually transmitted infections (STIs) is frequently the result of delayed diagnosis or treatment, which can lead to genital inflammation and predisposes patients to a higher risk of HIV acquisition (Lawal et al., 2019). GUIs are commonly caused by bacterial species such as N. gonohorreae, Trichomonas vaginalis and Treponema pallidum (Dembetembe et al., 2023). Fungal and viral aspects include Candida albicans and Herpes Simplex Virus respectively and bring the need for antifungal and antiviral properties to be activated as they cause disease (Dembetembe et al., 2023). Huleihel and Abu-Jafar (2017) validated the Eucalyptus camaldulensis 80% methanol extract offered antiviral activity against herpes simplex virus-1 and 2 (HSV-1, HSV-2) and Varicella-Zoster Virus (VZV) renderng the effectiveness of medicinal plants against STIs. Wound healing capability is also required to deal with the challenges of infections that result in warts or open wounds. Plants have multipharmacological qualities, which makes it easier to deal with illnesses that spread and affect various parts of the body. Common use of conventional antibiotics has seen the rise of resistance to the drugs by some isolates of N. gonohorreae (Unemo et al., 2012; Dembetembe et al., 2023). From the review H. caespititium and X. caffra have been reported to possess antigonorrhea activity. Another notable medicinal plant identified in this review is Peltophorum africanum of the Fabaceae family. Pharmacological studies have revealed that P. africanum exhibits strong anti-gonococcal activity and activity against C. albicans and G. vaginalis. Additionally, it has been found to inhibit HIV-1 reverse transcriptase (Naidoo et al., 2013; Mamba et al., 2016). This further validates their etnomedicinal use against Neissiria gonohorreae and other related STIs. Notable plants have been highlighted to possess anti-HIV properties which have been reported to suppress GUIs in HIV immunocompromised patients these include A. karoo, E. tirucalli, M. indica, M. glaber, T. sericea and X. caffra, acute kidney injury, renal fibrosis, diabetic nephropathy, lupus nephritis and kidneystones are among the kidney diseases for which a growing body of recent research suggests green tea may be a promising therapeutic or protective agent (Kanlaya et al., 2019). Some plant species (17.6%) in Table 3 pharmacological records are not known and are unvalidated. This gives enough room for further study of these plants to validate their use in herbal medicine, as plants possess more than one pharmacological property and they can be applied to other human or animal infections.

Table 3: Pharmacological and toxicological assessment of traditional medicinal plants for genitourinary health in Zimbabwe

Scientific names	Pharmacology	Toxicology	References
A. esculentus	Antioxidant, anti-inflammatory, laxative, anti-hyperlipidemic, antifungal, and analgesic activities.	Safe LD50 > 2000 mg/kg	(Doreddula et al., 2014)
A. karoo	Antioxidant, antibacterial, antifungal, antimicrobial, anti-helmintic, analgesic, HIV1 reverse transcriptase, antilisterial, anti-gonococcal, anti-diabetic, anti-inflammatory, antimalarial and anti-mycobacterial.	Weak or low toxicity or mildly toxic LD50 < 1600mg/kg	(Adedapo et al., 2008; Nielsen et al., 2012; Maroyi, 2017a; Njanje et al., 2017)
A. nilotica	Antibacterial, antifungal, anthelmintic, antioxidant, anti-diarrhoeal, acetyl cholinesterase (AChE) inhibitory, anti-platelet aggregatory, antihypertensive, antispasmodic, anti-inflammatory, anti-plasmodial, analgesic, antipyretic, antiviral and anticancer activities.	Safe LD50 value of 2700±215 mg/kg of body weight.	(Meena et al., 2010; Rather and Mohammad, 2015; Jame, 2018; Manzo et al., 2019)
A. gummifera	Antiviral, cytotoxicity and antioxidant activities.	no data available	(Fullas et al., 1995; Adedapo et al., 2008; Ndhlala et al., 2013)
A. antunesiana	Anthelmintic and anti-oxidative activities.	no data available	(Maroyi, 2013a; Chipiti et al., 2013)
A. globuligemma	Cyclooxygenase inhibitory activity (anti-inflammatory)	no data available	(Lindsey et al., 2002)
A. greatheadii	Antioxidant, antibacterial, anti-diabetic, antiviral, antimalarial and antifungal effects.	no data available	(Amoo et al., 2014; Loots et al., 2011)
Aloe spp	Antiviral, antibacterial, antifungal, anti-inflammatory, immunomodulatory hypoglycemic and gastroprotective properties	Safe LD 50 - 2000 mg/kg of body weight	(Steenkamp and Stewart, 2007; Mukherjee et al., 2014)
A. senegalensis	Anticonvulsant, cytotoxic, analgesic, antioxidant, antivenomous, hypnotic, anthelmintic, in vivo trypanocidal activity, anti‑snake venom activity, antinoceptive activity, anthelmintic activity	Safe LC 50 µg/ml - leaves 1190 ± 212 µg/ml and roots 2 300 ± 276 µg/ml, non-toxic LD50 > 2000mg/kg in rats	(Munodawafa et al., 2016; Okhale et al., 2016; Amudha and Vanitha, 2017; Maroyi, 2019a)
A. stenophylla	Antibacterial, antifungal, anti-inflammatory, antioxidant and hypoglycaemic activities.	Safe Brine Shrimp Lethality Test results (LC 50 µg/ml) - leaves 1 190 ± 212 µg/ml and roots 2 300 ± 276 µg/ml, non-toxic LD50 > 2000mg/kg in rats	(Munodawafa et al., 2016; Maroyi, 2019a)
B. fassoglensis	no data available	no data available	
B. discolor	Anti-hyperglycaemic activity	no data available	(Mellem et al., 2013)
B. boehmii	Anti-inflammatory and antioxidant activities	no data available	(Chirisa and Mukanganyama, 2016)
Caralluma spp	Antibacterial, antifungal, hypolipidemic, antimutagenic, analgesic, antioxidant, hypolipidemic, wound healing potential, immunostimulating, anti-inflammatory, hyperglycemic, anthelminthic, anticancer, antitubercular, atoprotective, antidiabetic, antiobesity, antinociceptive, antiobesogenic and antiatherosclerotic activities. Effect on food intake, appetite and anthropometry.	Safe LD50 - 2154 mg/kg orally	(Vajha et al., 2010; Adnan et al., 2014; Malladi et al., 2018)

C. papaya	Antimicrobial, anthelmintic, anti-plasmodial, antifungal, anti-amoebic, anticonvulsant, effecting muscle smoothing, male & female antifertility, hepatoprotective, diuretic, topical use, immunomodulatory and histaminergic activities.	Safe LD50 - 2000 mg/kg BW	(Krishna et al., 2008; Halim et al., 2011; Roshan et al., 2014; Patil et al., 2014; Sugiharto, 2020; Alara et al., 2020; Omara, 2020)
C. spinarum	Anti-plasmodial, antioxidative, diuretic, antiherpetic, anti-inflammatoty and antiviral activities.	Safe LD50 - 2154.1 mg/kg, non-toxic LD50 > 2000mg in rats	(Kaunda and Zhang, 2017; Ibrahim et al., 2015; Woode et al., 2007; Osseni et al., 2016)
C. abbreviata	Antiviral, antioxidant and antimicrobial activities.	Safe LC50 values of 1319.37 ± 356.63µg/ml. The bark had LC50 values of 454.93 ± 18.60µg/ml and the leaves had LC50 values of 445.72 ± 22.15µg/ml are moderately toxic.	(Viol, 2009)
C. singueana	Antioxidant, antiplasmodial, antiulcer, antipyretic, anti-inflammatory and analgesic activities.	Safe LD50 - 2150 mg/kg bd. wt.	(Umar et al., 2019; Uko et al., 2019)
C. taylorii	Anti-allergic, anti-inflammatory, analgesic, immunomodulatory activity, antibacterial, antioxidant, emetic, antipyretic, human cyclooxygenase (COX)-2 inhibitory effects and a prominent protection of DNA.	Safe LD50 up to 2000 mg/kg.	(Moura et al., 2018; Saini et al., 2019)
C. mucronata	Hypoglycemic, antivenin, anti-diabetic, anti-ulcer, antispasmodic, antidiarrhoeal and possess effects on male fertility.	Safe LD50 > 5000 mg/kg body weight intraperitoneally.	(Tanko et al., 2007; Garba et al., 2014)
C. ternatum	no data available	no data available	
C. erythrophyllum	Antibacterial, antifungal, anthelmintic, antioxidant, anti-inflammatory, cytotoxic, genitourinary and mutagenic and enzymatic activity Inhibition of topoisomerase.	no data available	(Schwikkard et al., 2000; Roy et al., 2014; Mawoza and Ndove, 2015; Photolo et al., 2020)
C. hereroense	Anthelmintic, antifungal, anti-inflammatory, cytotoxicity	no data available	(Roy et al., 2014)
C. platypetalum	Cytotoxic, anti-inflammatory and antioxidant activities.	no data available	(Chirisa and Mukanganyama, 2016; Chiramba and Mukanganyama, 2016)
C. marlothii	no data available	no data available	
C. macowanii	Anti-amnesic, antiviral, analgesic, acetylcholinesterase inhibitory, emetic, antitumour, antibacterial, anti-infectility, immunostimulatory, antimalarial, blood pressure, diaphoretic and heart rate effects	Safe or non toxic LD50 at a concentration of 10 mg/kg body weight	(Nair et al., 2000; Fennell and Van Staden, 2001; Mugabo et al., 2014; Mugwagwa et al., 2015; Maroyi, 2016; Jilani et al., 2018; Morare et al., 2018)
C. gratissimus	Good antioxidant, anti-diabetic, anti-inflammatory, antibiotic, antiviral, anticancer, immunomodulatory, anti-pyretic, analgesic, antileishmanial, anti-plasmodial, anticonvulsant, antiulcer, hypolipidemic, antiarthritic, anti-eczemic, antihistimic and anti-coronary properties.	Highly toxic LC50 - Hexane fraction - 25.3±0.87 µg/ml.; DCM fraction - 67.3±0.32 µg/ml.	(Okokon et al., 2005; 2011; Salatino et al., 2007; Okokon et al., 2013; Mfotie Njoya et al., 2018; Mahmoud et al., 2020)

C. oblongifolia	Antivenin and anti-phospholipase A2 activities.	no data available	(Umar et al., 2014)
C. junceum	no data available	no data available	
D. stramonium	Anti-inflammation, antiviral, antimicrobial, analgesic and anti-asthmatic activities.	Safe LC50 - 12860 µg/ml	(Gaire and Subedi, 2013; Sayyed, 2014)
D. cinerea	Antioxidant, antiviral and antimicrobial activity.	Safe LC50 - 539.39 ± 78.24 µg/ml and the roots - 4304.59 ± 685.69µg/ml.	(Viol, 2009; Viol et al., 2016)
D. anomala	Anthelmintic, anticancer, antihyperglycemic, anti-inflammatory, antimicrobial, antioxidant, antiplasmodial, and hepatoprotective activities	Safe LC50 value of 3 040±1060 µg/ml	(Maroyi, 2018a, Munodawafa et al., 2016)
D. condylocarpon	Sympatholytic and anti-plasmodial activities.	no data available	(Clarkson et al., 2004; Moura et al., 2018)
D. rotundifolia	Antibacterial, anti-inflammatory and cytotoxicity activities.	no data available	(Reid et al., 2001; Kudumela et al., 2018)
E. matabelicum	Antimicrobial and antioxidant.	Safe LC50 value of 1012.31 ± 217.69µg/ml	(Viol, 2009; Viol et al., 2016)
E. goetzei	Anthelmintic, antioxidant, antibacterial, antifungal, antiviral, and cytotoxicity assays.	Moderately toxic LC50 - 356.55 ± 24.55 µg/ml.	(Maroyi, 2017b, 2017c, 2017d)
E. caudatum	no data available	no data available	
E. englerianum	Antimicrobial and antioxidant activities.	no data available	(Lawal and Ogunwande, 2013)
E. livingstoniana	Antibacterial and antioxidant.	no data available	(Bedane et al., 2016)
E. abyssinica	Antimycobacterial and antimicrobial activities.	Safe LC 50 µg/ml - roots 5 440 ± 0 µg/ml, acute toxicity test gave an LD50 of 776.2mg/kg.	(Bunalema et al.,2011; Munodawafa et al., 2016; Chitopoa et al., 2019)
E. natalensis	Antibacterial, antidiabetic, antifungal, antimycobacterial, antiviral, antioxidant, antiplasmodial, larvicidal, antischistosomal, molluscicidal, dentin permeability and hepatoprotective activities	Highly toxic LC50 value of 19.33 µg/mL.	(Maroyi, 2017d)
E. tirucalli	Wound healing, antiviral, human-lymphocytes, anthelmintics, antiarthritic, genotoxic/mutagenic, insect repellants, antibacterial/antifungal/antimicrobial, anti-HIV, myelopoiesis, larvicidal, CNS depressant/neuropathic pain, anti-inflammatory, hepatoprotective, analgesic, antioxidant, cytotoxicity, anticancer, immunomodulatory, molluscicidal/ovicidal/piscicidal, proteolytic/chitinolytics activities.	Moderately toxic LC50 - 481.85 µg/ml	(Patil and Mugdum, 2012; Wal et al., 2013; De Araújo et al., 2014; Machado et al., 2016; Mali and Panchal, 2017; Alves da Paz et al., 2020)
F. sur	Antimalarial, antimicrobial, anti-inflammatory, antioxidant, ameliorative and anti-anemic activities.	no data available	(Muregi et al., 2007; Solomon –Wisdom et al., 2011; Akoto et al., 2020; Ojukwu and Ibekwe, 2018; Yakubu et al., 2020)

F. indica	Antimicrobial, hepatoprotective, anti-diabetic, antimalarial, anti-plasmodial, antioxidant, anti-inflammatory, anti-asthmatic and antiviral activities.	Moderately toxic The root extract was found to be moderately safe to use, 467.31 ± 39.01 µg/m using BSLT.	(Kota et al., 2012; Sashidhara et al., 2013; Hussain et al., 2016; Viol, 2009; Viol et al., 2016)
G. capitata	Antityrosinase, anticancer, antioxidant and antibacterial activities	no data available	(Kambizi et al., 2017)
G. bicolor	Anti-pyretic, anti-oxidant, anti-malarial, hepatoprotective, anti-inflammatory, anti-helminthic, anti-emetic, analgesic and serotonin-like activities	Safe LD50 - 2663.92 mg/kg	(Jaspers et al., 1986; Mohamed et al., 1990; Ullah et al., 2012; Nyakudya et al., 2015; Ibrahim, 2017)
G. flavescens	no data available	no data available	
G. monticola	no data available	no data available	
G. senegalensis	Antioxidant, antiviral, antibacterial, antileishmanial and antifungal activities.	Safe LC50 value of 2185.61 ± 872. 25µg/ml, were found to be safe to use, non-toxic LD50 > 1600mg/kg in mice	(Khalid et al., 2007; Viol, 2009; Malebo et al., 2015; Viol et al., 2016; Makgatho et al., 2018)
H. caespititium	Antibacterial, antigonorrhea, antimycobacterial, antifungal, antioxidant, and cytotoxicity activities	Highly toxic LC50 value of 82.9 µg/ml	(Maroyi, 2019b)
H. cannabinus	Cytotoxic, inhibition of glycosylation, anthelmintic, antibacterial, antihyperchol, esterolemic, antiulcer, anti-diabetic, blood pressure lowering, hepatoprotective, hypolipidemic, atherosclerosis, antioxidant, immunological, chemopreventive, haematinic and reduced serum cholesterol effects.	Safe LD50 - 4470 mg/kg	(Al-Snafi, 2018; Dhar et al., 2015; Kowti et al., 2020; Sim and Nyam, 2020)
H. pubescens	Analgesic, antibacterial, anti-amoebic, anti-inflammatory and antimalarial, and antioxidant activities	Safe The animal treated with doses 500, 1000 and 2000 mg/kg.	(Sinha et al., 2013; Singh, 2018)
H. abyssinica	Antibacterial, antioxidant, antiglycation and antifungal activity.	no data available	(Saadabi and Ayoub, 2009; Yagi et al., 2013)
H. filipendula	no data available	no data available	
H. hemerocallidea	Anticonvulsant, uterolytic, anti-motility, anti-inflammatory, immunomodulation, antineoplastic, antinociceptive, anti-diabetic, antibacterial, hypoglycaemic, antioxidant, anti-infective, cardiovascular, spasmolytic, anti-cholinergic effects.	Weak or low toxicity or mildly toxic LD50 value of 1785 ± 116 mg/kg.	(Mills et al., 2005; Ojewole, 2008; Drewes et al., 2008; Katerere and Eloff, 2008; Owira and Ojewole, 2009; Ndhlala et al., 2013; Havenga et al., 2018; Matyanga et al., 2020)
H. obtuse	Inhibitory effects on all the CYP isoforms	no data available	(Gwaza et al., 2012)
I. arrecta	Antimicrobial, analgesic, anti-diabetic, anti-inflammatory, anti-hyperglycemic and antinociceptive effects.	Safe LD50 of ≥ 5000 mg/kg.	(Nyarko et al., 1993; Nyarko et al., 1999; Suleiman et al., 2015)
I. glomerata	no data available	no data available	
K. anthotheca	Antimicrobial, antioxidant and antiviral activities.	Moderately toxic LC50 - 482.19 ± 43.49 µg/ml.	(Viol, 2009; Viol et al., 2016)

K. africana	Antiplasmodial, antiviral, antimicrobial, antioxidant, antitrypanosomal and anti-inflammatory activities.	Highly toxic LC50 of the fruit and the bark (262.20 ± 5.07µg/ml) were found to be toxic, giving readings less than 300µg/ml.	(Viol, 2009; Viol et al., 2016)
L. discolor	Anthelmintic, antibacterial, antimycobacterial, antifungal, antioxidant, antiplasmodial, and nematicidal activities.	Safe The extracts exhibited low toxicity against the three cell lines with the median lethal concentration values ranging from 0.408 mg/mL to >1.0 mg/mL	(Maroy, 2018b, 2019c)
L. edulis	Anthelmintic, anti-human immunodeficiency virus, antihyperglycemic, antihyperlipidemic, antimalarial, antimicrobial, antioxidant, and cytotoxicity activities.	Safe The LD50 value of the extract was greater than 6000 mg/kg	(Munodawafa et al., 2016; Maroyi, 2019)
S. lycopersicum	Platelet anti-aggregation, endothelial protection, anti-tumour, anthelmintic, anti-inflammatory, anti-obecity, anti-carcinogenic, muscle relaxant, anti-epileptic, antioxidants, clastogenic, antifungal, chromosome aberrations, anti-mutagenic and enzymatic activity (bypassing kinase and high invertase).	Safe LD50 > 2000 mg/kg	(Raja et al., 2010; Gautam, 2013; Devi et al., 2014; Shukla and Kumar, 2015; Kumar and Lakhan, 2020)
M. indica	Anti-inflammatory, antimicrobial, antioxidant, antidiarrheal, antiparasitic, hepatoproctective, immunomodulation, anti-HIV, antispasmodic, antibone reorption, hypolipemic, gastroprotective, antipyrectic and analgesic activities.	Safe LD50 ≥ 5000mg/kg in rats.	(Thambi et al., 2008; Garrido et al., 2009; Parvez, 2016)
M. esculenta	Antiradical, antiseptic, cyanogenic, demulcent, antioxidant, diuretic, anti-inflammatory, anagelsic, antihemorrhoid and antimicrobial activities.	no data available Cassava (Manihot esculenta Crantz) contains cyanogenic glycosides.	(Thiyagarajan and Suriyavathana, 2010; Bahekar and Kale, 2013; Dougnon et al., 2020)
M. azedarach	Antiplasmodial, rodenticidal, cathartic, antidiarrhoeal, antipyretic antioxidant, anti-inflammatory, antimicrobial, insecticidal, deobstruent, diuretic, antidiabetic, antihypertensive, antiulcer, antifeedent, antifertility, cardioprotective, emetic, antirheumatic analgesic, CNS sedative, anticancer, immunomodulatory and male contraceptive properties	Moderately toxic LD50 was 395, 500mg/kg (flowers) and 700, 925mg/kg (berries) respectively in mice and rats.	(Zakir-Ur-Rahman et al., 1991; Vishnukanta, 2008; Azam et al., 2013; Sharma and Paul, 2013; Xiao et al., 2014)
M. glaber	Antifungal and HIV-inhibitory activities	no data available	(Kenez et al., 2008; Moura et al., 2018)
Musa spp	Antioxidant, antibacterial, antiviral, anti-ulcerogenic, antithrombotic, anti-allergic, anti-inflammatory, antiallergenic, anti-diabetic, diuretic, mutagenecity, wound healing, antidiarrhoeal, antimalarial, anti-snake venom and vasodilatory actions	Safe LD50 >5000 mg/kg	(Imam and Akter, 2011; Pereira and Maraschin, 2015; Ugbogu et al., 2018)
N. oleander	Antinociceptive, antiinflammatory, antioxidant, anti-asthmatic, anticancer, hepatoprotective and antibacterial, antidiarrhoeal, antimicrobial, diuretic, antileukemic, immunomodulatory, larvicidal, antibacterial, anti-diabetic, antiulcer and molluscicidal activities.	Highly toxic LC 50 - Leaves 142 ± 68.2 µg/ml	(Garima and Batra 2010; Hase et al.,2016; Munodawafa et al., 2016)
O. dissitiflora	Larvicidal activity	no data available	(Mavundza et al., 2016)

O. reticulata	Antimicrobial, cytotoxic, antibacterial and anthelmintic activities.	Highly toxic Roots LC50 - 2.21 *µ*g/ml; LC50 = 10.63 µg/ml	(Moshi et al., 2004; Nyaberi et al., 2010; Haule et al., 2012; Maroyi, 2013a; Nyaberi, 2014)
P. bisacculatu	no data available	no data available	
P. curatellifolia	Antioxidant, antibacterial and anti-diabetic activities.	Safe Roots ethanol extract LC50 >1000 µg/ml and stem barks LC50 - 476.67 µg/ml	(Mbunde et al., 2017)
P. schumanniana	no data available	no data available	
P. africanum	Antibacterial, antifungal, antiviral, antioxidant and anthelmintic activity.	Weak or low toxicity LC 50 - leaves 913 ± 7.32 µg/ml, bark 882 ± 106 µg/ml and roots 1 060 ± 106 µg/ml	(Mongalo, 2013; Munodawafa et al., 2016)
P. mauritianus	no data available	no data available	
P. africana	no data available	no data available	
P. gazensis	no data available	no data available	
P. decipiens	no data available	no data available	
P. mixta	Antifertility effects	Safe LD50 - 4000 mg/kg	(Sewani-Rusike 2013)
P. maprouneifolia	Anti-inflammatory, anti-oxidant, hypoglycaemic and anti-diabetic activities	no data available	(Motlhanka 2012; Lawal et al., 2019)
P. febrifugum	Anti-bacterial, anti-protozoal, anti-acne, anti-fungal, anti-viral, anti-cancer, anti-oxidant, and neuroprotective effects.	Safe LD50 >2000 mg/kg body weight.	(Epifano et al., 2013; Elufioye et al., 2016; Agbogba et al., 2019)
P. angolensis	Antibacterial, anti-plasmodial and antifungal properties.	Safe Safe: roots 1 320 ± 266; Moderately: safe bark 478 ± 29.7	(Munodawafa et al., 2016; Zininga et al., 2017; Chipinga, 2018)
R. communis	Antioxidant, anticancer, immunomodulatory, hepatoprotective, analgesic, lipolytic, antihistaminic, cytotoxic, wound healing, antidiabetic, antiulcer, insecticidal, immunomodulatory, antimicrobial, anti-asthmatic, lipolytic, antifertility, antiimplantation, antinociceptive, molluscicidal and larvicidal, bone regeneration, and anti-inflammatory activity.	no data available	(Kumar, 2017)
S. hyacinthoides	Anthelmintic, antibacterial, antifungal, and antioxidant activities.	no data available	(Maroyi, 2013a, 2019d; Thu et al., 2021)
S. pinnata	Antioxidant, antibacterial, anti-inflammatory, antimycobacterial, anti-diarrhoeal, hypoglycaemic and antiglycation activities.	Highly toxic LC50 - < 25.0 µg/ml	(Maroyi, 2013a; Kudumela et al.,2018; Beseni et al., 2019; Kudumela et al., 2019; Masoko and Masiphephethu, 2019)

S. chirindensis	Antiviral, antifungal, antioxidant antibacterial, analgesic and anti-inflammatory.	Weak or low toxicity or mildly toxic LC50 value of 1023.26 ± 161.69µg/ml. However, the root extract has given low readings, 316.60 ± 30.07µg/ml, nontoxic, LD50 value of 1574 ± 87 mg/kg in mice	(Viol, 2009; Viol et al., 2016; Ojewole, 2007)
S. longipes	Antioxidant activity	Safe LD50 > 5000 mg/kg /body weight.	(Olorunnisola et al., 2017; Mtunzi et al., 2017)
S. longepedunculata	Antibacterial, anti-plasmodial and antifungal properties.	Safe Safe: roots 1 320 ± 266 µg/ml LD50 gave a value of 37 mg/kg	(Dapar et al., 2007; Munodawafa et al., 2016; Zininga et al., 2017; Chipinga, 2018)
S. latifolius	Antiemetic, antibacterial, antitubercular, anti-inflammatory, vasodilatory, antifungal, teratogenic and/or carcinogenic effects.	no data available	(Steenkamp et al., 2001; Yang et al., 2011)
S. campylacanthum	Antinociceptive effect, antipyretic, antimicrobial, anti-inflammatory, analgesic and anti-cytotoxic activity	Safe LD50 > 2000mg/kg body weight. Oral administration of up to 15,000 mg/kg doses	(Indhumathi and Mohandass, 2014; Dakone and Guadie, 2016; Anwar, 2018; Mwonjoria et al., 2014)
S. pruriens	no data available	no data available	
S. africana	Anti-proliferation, antioxidant and antibacterial activity	no data available	(Mathabe et al., 2008; Maroyi, 2013a; Direko et al., 2019)
S. araliaceae	Antimitotic, antitubulin, uterotonic, antioxidant, antibacterial, diuretic, anti-leishmanial, larvicidal and antiplasmodial activity	no data available	(Wang et al., 1977; Demoz et al., 2014; Mailu et al., 2020)
S. cocculoides	Antimalarial and antioxidant activity.	no data available	(Sunghwa and Koketsu, 2009; Maroyi, 2013a; Ngadze et al., 2018)
S. spinosa	Antimicrobial, anti-inflammatory, antioxidant, antiallergic, hepatoprotective, antithrombotic, antiviral, and anti-carcinogenic activities	Safe LD50 > 5000mg/kg.	(Isa et al., 2014)
S. madagascariensis	Antimicrobial, nephroprotective, insecticidal, hypoglycemic and antioxidant activities.	Toxic LD50 of 288.5mg/kg	(Sani et al., 2016; Constance et al., 2019; Amang et al., 2020)
S. cordatum	Antibacterial, antiplasmodial, antifungal, antidiarrheal, anti-sexually transmitted infections, antidiabetic, antioxidant, anti-inflammatory, antileishmanial, anti-proteus and anticholinesterase.	Safe LD50 > 4000mg/kg in mice	(Cordier et al., 2013)
T. indica	Anti-diabetic, anti-inflammatory, anti-asthmatic, antioxidant, anti-venomic, hepatoprotective, anti-microbial, anti-malarial, laxative, immunomodulatory and anti-hyperlipidemic activity.	Safe LD50 - 1,265 mg/kg.	(De Caluwé et al., 2010; Meher et al., 2014; Yerima, 2015; Ahmad et al., 2018)

T. brachstemma	Anthelmintic effect	no data available	(Mølgaard et al., 2001)
T. sericea	Antibacterial, antifungal, anti-neurodegenerative, anticancer, antioxidant, antiviral, anti-HIV, anti-fungal, antibacterial, anticancer, lipolytic, wound healing, antiparasitic, anti-inflammatory and anti-oxidant activity	Moderately toxic LC50 < 300µg/ml.	(Viol, 2009; Viol et al., 2016; Mongalo et al., 2016; Parkar, 2016; Nair et al., 2018; Sobeh et al., 2019)
T. ciliata	Antibacterial, antioxidant, anti-inflammatory, antimicrobial, anti-cancer, hypoglycaemic, spasmolytic, anti-glycation, antiprotozoal, analgesic, antiulcer, antifungal, anti-feedant and cytotoxicity properties	Toxic LD50 - 300 mg/kg	(Kiladi, 2012; Kumar et al., 2012; Nisa et al., 2013; Hossain et al., 2014; Gou et al., 2017; Beseni et al., 2019)
T. ambacense	no data available	no data available	
T. welwitschii	Antibacterial properties.	no data available	(Moyo and Mukanganyama, 2015)
T. nilotica	Cytotoxic and antiplasmodial activities	no data available	(Irungu et al., 2015)
V. infausta	Antibacterial, antimycobacterial, antifungal, anti-inflammatory, antileishmanial, antioxidant, antiplasmodial, antifeedant and prostaglandin synthesis inhibitory activities	Moderately toxic LC50 values of 338±23.4 µg/mL and 416 ± 28.3 µg/mL	(Maroyi, 2018c)
V. amygdalina	Antimicrobial, antimalarial, antithrombotic, antioxidant, antipyretic, analgesic, anti-diabetic, laxative, hypoglycemic, anticancer, antihelmintic, antifertility, anti-inflammatory, cathartic, antifungal and antibacterial.	Moderately toxic LD50 of 5152.3 mg/kg. LD50 was found to be 3721 mg/kg. On administration of 5000 mg/kg dose.	(Abosi and Raseroka, 2003, Alara et al., 2017; Tijjani et al., 2017; Asfere et al., 2018; Danladi et al., 2018)
V. colorata	Antimicrobial, antimalarial, antiviral, antiascorbic, antiplasmodial, anti- norexic, anti- helmintic, hypoglycaemic and anti-diabetic activity	Safe LD50 > 5000 mg/kg	(Sy et al., 2005; Julien et al., 2012; Ndhlala et al., 2013; Idris et al., 2016)
V. glaberrima	Anticancer, analgesic, anticancer, antiviral, anti-inflammatory analgesic, anti-diabetic, anti-inflammatory antimalarial and antimicrobial activities.	Safe LD50 > 5000 mg/kg.	(Abdullahi et al., 2015; Alhassan et al., 2018; Jega et al., 2020)
V. glabra	Antimicrobial, antifungal and anti-giardial activity	no data available	(Johns et al., 1995; Ngonda et al., 2012; Kitonde et al., 2013; Maregesi and Mwakalukwa, 2015)
V. payos	no data available	no data available	(Tufts et al., 2015)
W. salutaris	Antimycobacterial, antioxidant, antiviral, antibacterial, antifungal, antifeedant, plant-growth regulatory, cytotoxic, phytotoxic, piscicidial, and molluscicidal properties	Moderately toxic Leaf and bark extracts, LC 50 - 351.41 ± 29.58µg/ml and 359.66 ± 14.33µg/ml.	(Lawal et al., 2014; Leonard and Viljoen, 2015; Nyaba 2017; Nyaba et al., 2018; Soyingbe et al., 2018; Maroyi, 2014, Viol 2009; Viol et al., 2016)
W. sulcata	no data available	no data available	
X. stuhlmannii	Antimalarial, antitumor, antioxidant, antiviral, antimicrobial, and anti-inflammatory properties.	no data available	(Chinemana et al., 1985, Selemani et al., 2020)
X. caffra	Anti-amoebic, antibacterial, antigonococcal agent, antifungal, anti-inflammatory, antioxidant, anti-parasitic, anti-proliferative, HIV-1 reverse transcriptase (RT) inhibitory, insecticidal, non-mutagenic and toxicity activities.	Highly toxic LC50 - 11.25 μg/ml	(Moshi et al., 2004; Mulaudzi et al., 2011, 2013; Maroyi, 2016)

Z. africana	Antibacterial, antifungal, antiviral, antidiabetic, anti-inflammatory, insecticidal, anti-trypanosomal and cytotoxicity activities.	Highly toxic LC50 values ranging from 41.1 µg/mL and 240.0 µg/mL	(Maroyi, 2019e)
Z. mucronata	Antimicrobial, antiviral, anti-diabetic, anti-inflammatory, anti-oxidant, anti-plasmodial, anthelmintic, and anti-anaemic activity	Safe LC50 > 1000 µg/ml; LD50 was found to be >5000 g/kg	(Mongalo et al., 2020 Fadladdin, 2021)
Z. glochidiata	no data available	no data available	

Table 4. Toxicological assessment of medicinal plants utilized by local communities in Zimbabwe for treating and managing genitourinary infections

Toxicological profile	No of plants	Names of the plant species
Safe LC50 ≥ 1000 µg/ml 2,000 ≤ LD50 ≤ 5,000 mg/kg body weight	41	*A. esculentus, A. nilotica, Aloe spp., A. senegalensis, A. stenophylla, Caralluma spp, C. papaya, C. spinarum, C. abbreviata, C. singueana, C. taylorii, C. mucronata, C. macowanii, D. stramonium, D. cinerea, D. anomala, E. matabelicum, E. abyssinica, G. bicolor, G. senegalensis, H. cannabinus, H. pubescens, I. arrecta, L. discolor, L. edulis, S. lycopersicum, M. indica, M. spp,, P. curatellifolia, P. mixta, P. febrifugum, P. angolensis, S. longipes, S. longepedunculata, S. campylacanthum, S. spinosa, S. cordatum, T. indica, V. colorata, V. glaberrima, Z. mucronata*
Weak or low toxicity or mildly toxic 500 ≤ LC50 ≤ 999 µg/ml 1,000 ≤ LD50 ≤ 2,000 mg/kg body weight	4	*A. karoo, P. africanum, H. hemerocallidea, S. chirindensis*
Moderately toxic 250 ≤ LC50 ≤ 499µg/ml 300 ≤ LD50 ≤ 1,000 mg/kg body weight	9	*E. goetzei, E. tirucalli, F. indica, K. anthotheca, M. azedarach, T. sericea, V. infausta, V. amygdalina, W. salutaris*
Toxic 50 ≤ LD50 ≤ 300 mg/kg body weight	2	*S. madagascariensis, T. ciliata*
Highly toxic LC50 ≤ 249 µg/ml 0 ≤ LD50 ≤ 50 mg/kg body weight	9	*C. gratissimus, E. natalensis, H. caespititium, K. africana, N. oleander, O. reticulata, S. pinnata, X. caffra, Z. africana*
No data available	54	*A. gummifera, A. antunesiana, A. globuligemma, A. greatheadii, B. fassoglense, B. discolor, B. boehmii, C. ternatum, C. erythrophyllum, C. hereroense, C. platypetalum, C. marlothii, C. cirsioides, C. oblongifolia, C. junceum, D. condylocarpon, D. rotundifolia, E. caudatum, E. englerianum, E. livingstoniana, F. sur, G. capitata, G. flavescens, G. monticola, H. abyssinica, H. filipendula, H. obtuse, I. glomerata, M. esculenta, M. glaber, O. dissitiflora, P. bisacculatus, P. schumanniana, P. mauritianus, P. africana, P. gazensis, P. decipiens, P. maprouneifolia, R. communis, S. hyacinthoides, S. latifolius, S. pruriens, S. africana, S. araliaceae, S. cocculoides, T. brachstemma, T. ambacense, T. welwitschii, T. nilotica, V. glabra, V. payos, W. sulcata, X. stuhlmannii, Z. glochidiata*

Toxicological Assessment of Medicinal Plants Used for Treating and Managing Genitourinary Infections in Zimbabwe

Toxicological evaluation studies have been documented for 54.62% of the listed medicinal plants for GUIs from Table 4. The other 45.38% from Table 4 do not appear on any published or recorded studies prior to March 2021. Extensive evaluation of toxicological activities was evaluated among the 119 plants with toxicological profiles. The evaluation omitted considerations of liver Chang cell interactions, monocyte cytotoxicity in humans, genotoxicity, and anticancer properties, among other aspects. The review emphasized the toxicological evaluation through two specific assays: The Brine Shrimp Lethality Test (BSLT) and the Acute Toxicity Rodent Assay. They are commonly used and have been cited more times than the other assays, as they are considerably accurate, cost effective and relatively simple with regards to herbal extracts (Munodawafa et al., 2016). By comparing Meyer's and Gosselin, Smith and Hodge's toxicity scales, Hamidi et al. (2014) found a positive correlation between LC50 and LD50 results therefore both assays are suitable for predicting the toxic effects of plant extracts on humans.

BSLT toxicity classification is determined by the concentration of herbal plant extracts that cause 50% mortality in brine shrimps (LC50) and a corresponding 50% mortality in rodents (LD50) during acute toxicity assessments (Munodawafa et al., 2016; Erhabor et al., 2020; Nyagumbo et al., 2022), offering preliminary insights into the toxicity of the extracts. As presented in Table 4, the BSLT and rodent acute toxicity assays were classified based on toxicological profiles by Bussmann et al. (2011); Malebo et al. (2015); Munodawafa et al. (2016); Erhabor et al. (2020); and Nyagumbo et al. (2022).Of the 65 medicinal plants assessed for their toxicological profiles, 63.08% were found to be safe or non-toxic, while 6.15% exhibited low or mild toxicity, 13.84% were moderately toxic, 3.08% were toxic, and 13.84% were classified as highly toxic (Table 4). Alarmingly, about 45% of these plants are currently utilized without any recorded toxicity data, underscoring the necessity for toxicological screening of the remaining 45% of the species listed. Further in vitro studies with organisms that cause GUIs is needed. Organisms suchas bacteria, fungi and viruses that are instrumental in the infections. It is important to note that various factors contribute to differences in the toxicity of medicinal plants, including the preparation and administration of the plant, the dosage, the environment, the type of phytochemical constituent (tropane alkaloids and cardiac glycosides), the extraction method, the solvent used for the extraction (organic and non-organic solvents), and the species of animal tested. Herbalists administer lower dosages, use extensive boiling for herbs, blend plants and herbs, refrain from herbal medicine prescription to pregnant women and taking necessary precautions in immunocompromised individuals as a way to manage, minimize and eliminate toxicity.

Conclusion

Despite being one of the most common infectious disease groups worldwide, the development of novel treatments for GUIs is still mostly ignored. Zimbabwe is rich in traditional medicinal plants that can be utilised to treat or manage genitourinary infections (GUIs). A total of 119 plants have been reported as being used for the management of GUIs, diversified into 44 plant families and 100 genera. The Fabaceae family has been reported to be the predominant plant species family. By December 2020, the pharmacological characteristics of an estimated 17.6% of plant species remained unvalidated by science. This provides ample opportunity for additional research on these plants to support their usage in herbal medicine. For GUIs, the important pharmacological properties included antibacterial, analgesic, antifungal, antiviral, antimicrobial, anti-inflammatory, wound healing, immunostimulatory and uroprotective properties. BSLT and acute toxicity assays were assessed, revealing that 54.62% of the toxicological evaluation studies focused on the documented medicinal plants. Reports indicated that 63.08% of the evaluated plants were deemed safe or non-toxic. However, the fact that roughly 45% of the referenced plant population currently in use lacks documented toxicity evaluations is concerning. This highlights the urgent need for further toxicological screening of the remaining plants to ascertain their safety profiles.

Declarations

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgement

N.A.

Consent for publications

All authors have read and approved the manuscript for publication.

Funding/support

This research did not receive any specific grant from funding agencies in the public, comercial, or not-for-profit sectors.

Authors' contributions

Elliot Nyagumbo: Conceptualization, Investigation, Methodology, Data curation, Validation, Visualization, Writing– original draft, Writing – review and editing. Trust Nyirenda: Conceptualization, Investigation, Methodology. Cephas Mawere Methodology, Data curation, Software. Alfred M Mutaramutswa: Data curation, Software, Writing – original draft. Godwins Ngorima: Validation, Visualization, Writing – original draft. Donald T Kapanga: Validation, Visualization, Writing – original draft. Leroy Nhari validation: Validation, Visualization, Writing – original draft. Marvellous Matsheza: Validation, Visualization, Writing – original draft. Michael Bhebhe: Conceptualization, Writing – review and editing. Fabian Maunganidze: Writing – original draft, Writing – review and editing. William Pote: Conceptualization, Writing – review and editing. Lucy Mabaya: Conceptualization, Writing– original draft, Writing – review and editing.

Ethical Considerations

Ethical issues (including plagiarism, data fabrication, double publication and submission, redundancy) have been completely looked into by the author.

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