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Research Article
Exotic Plants in Indigenous Pharmacopoeia of South-Central Zimbabwe: Traditional Knowledge of Herbal Medicines

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Abstract

Background and Objective: Medicinal plants are important for primary healthcare needs of both rural and urban communities in Zimbabwe and among these are exotic plants. The aim of this study was to document exotic plants used as herbal medicines in Shurugwi District in South-central Zimbabwe. **Materials and Methods:** Semi-structured interviews, personal observations and guided field walks were conducted between December, 2014 and January, 2015 with 128 community members and traditional healers from seven villages to obtain ethnobotanical data on the use of exotic plants as herbal medicines. Data collected included names of exotic plants used, plant parts used, methods of herbal preparation and administration. Statistical Package for the Social Scientists (SPSS) was used to analyze collected data. **Results:** Total 26 exotic plants belonging to 15 families and 23 genera, mostly from Euphorbiaceae and Solanaceae (15.4% each), Asteraceae (11.5%), Apocynaceae and Myrtaceae (7.7% each) were used to traditionally manage 21 human and 4 animal diseases and ailments. The majority of the plant species used (69.2%) had one or two therapeutic uses. Plant species with at least three therapeutic uses were *Bidens pilosa*, *Citrus lemon*, *Datura stramonium*, *Eucalyptus camaldulensis*, *Nicotiana tabacum*, *Psidium guajava* and *Schkuhria pinnata*. **Conclusion:** This study revealed that exotic plant species play an important role in provision of primary health care to local communities in South-central Zimbabwe.

Key words: Exotic plant species, herbal medicines, indigenous pharmacopoeias, Karanga ethnic group, Shurugwi district

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Competing Interest: The author has declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Exotic or non-native plants are receiving more attention worldwide because of increased rate of biological introductions. Research by Clout and Williams[1] revealed that the transport of exotic plants by humans since the earliest times and now through increased levels of trade and tourism has led to the widespread breaching of natural biogeographic barriers at historically unprecedented rates. Exotic plant species that have escaped from cultivation are usually divided into three categories: Casual, naturalised and invasive. According to Pysek *et al.*[2], casual aliens reproduce occasionally outside cultivation, do not form self-sustaining populations and rely on repeated introductions for their persistence. Naturalised species are defined as aliens that reproduce consistently without direct human intervention and invasive aliens as naturalised species producing offspring in large numbers and at considerable distances from the parent plants with the potential to spread over a large area[2]. The invasion of natural habitats by exotic species is considered as one of the biggest threats to biodiversity[3] as alien species competitively displace native species through direct competition for abiotic resources[4].

Exotic plants are known to present a wide range of threats to native eco-systems and human well-being and therefore, governmental agencies and non-governmental organizations are frequently mandated to prevent the introduction of exotic species and minimize their negative effects[5]. Research by Ewel *et al.*[6] showed that exotic plant species have desirable uses as numerous species have been deliberately introduced for agricultural, ornamental and recreational purposes. Exotic plant species are also employed as medicines throughout the world and are now recognized as an important component of indigenous pharmacopoeia in several countries[7]. Alencar *et al.*[8] argued that any indigenous medical system is not a static social institution that is not evolving, as there is evidence of insertions and deletions of plants that compose it, with the addition of exotic plants as herbal medicines. In an earlier study, Alencar *et al.*[9] found that exotic plants are included in traditional pharmacopoeias to fill therapeutic vacancies that native plants cannot satisfy. While Palmer[10] argued that the medicinal plant collection of a community is the product of experimentations conducted throughout the history of a community and represents an adaptation of this culture over time. Bennett and Prance[7] argued that exotic plants that are used by a cultural group as food source or ornamental, may eventually be introduced into their traditional pharmacopoeias mainly because of the use-versatility of such species. Similarly, Alencar *et al.*[9] found exotic plants in Brazil to have more use-citations than native plants and the documented uses included applications as herbal medicines in addition to general uses as food plants or ornamentals.

Some of the cultivated, naturalized or invasive plant species that are often prescribed as herbal medicines include *Agave americana* L., *Aloe vera* (L.) Burm.f., *Cannabis sativa* L., *Carica papaya* L., *Catharanthus roseus* (L.) G. Don., *Moringa oleifera* Lam., *Musa* X *paradisiaca* L., *Nicotiana tabacum* L., *Opuntia ficus-indica* (L.) Mill., *Psidium guajava* L. and *Zingiber officinale* L.[7,11,12]. Previous studies in Bangladesh[13], Brazil[8], Hawai[10], India[14], Kenya[15], Mexico[16] and South Africa[11,12] showed that exotic plants play an important role in the traditional primary healthcare of local communities. It is within this context that an ethnobotanical survey of exotic plant species used as herbal medicines in South-central Zimbabwe was undertaken. Although indigenous knowledge on medicinal uses of native plants in Zimbabwe is well documented[17-21], very little is known about the medicinal uses of exotic species. The current investigation attempts to fill some of the gaps in indigenous knowledge related to the diversity of exotic plant species used as traditional medicines in Zimbabwe. Documentation of all categories of medicinal plants, whether indigenous or not is important, because as time passes, the distinction between natural and man-made landscapes becomes obscure[22]. Therefore, documentation of exotic plants used as traditional medicines is essential, as this will assist in the formulation of plant introduction policies in Zimbabwe. The aim of this study was to document exotic plants used as herbal medicines in Shurugwi District in South-central Zimbabwe.

MATERIALS AND METHODS

Study area: This study was conducted in Shurugwi district (Fig. 1), centrally located in the Midlands province, South-central Zimbabwe. The study area lies between 19°57'S-20°30'S latitude and 30°00'E-30°58'E longitude. The study area lies in agro ecological region 3, a semi-intensive agricultural region characterized by annual rainfall of between 650-800 mm a year[19]. In the hottest month, October, the mean temperature is 31°C and in the coldest month, July, the mean temperature is 9°C[23]. Severe mid-season dry spells and an unreliable start to the rainy season make the area marginal for agricultural crops and other water-dependent activities. Soils are sandy loam largely derived from granitic-gneissic rocks characterised by low agricultural potential due to low fertility, water-holding capacity, low pH and deficiencies in nitrogen,

Fig. 1: Geographical location of the study area in relation to other major towns in Zimbabwe

phosphorus and sulphur[23]. The most extensive vegetation type in the study area is drier miombo woodland in which *Brachystegia spiciformis* Benth. and *Julbernardia globiflora* (Benth.) Troupin are dominant in terms of basal area, with patches of *Hyparrhenia* spp., *Eragrostis* spp., *Heteropogon* spp. and *Digitaria* spp. grasses[19]. The study area has a poorly developed road network and infrastructure. Previous studies revealed that the study area is characterized by low levels of economic activity, forcing several households to engage in non-farm activities as potential sources of income[19,23]. Other income is generated by seasonal labour in urban areas, specialized occupations including operating small shops, retirement pension and remittances by family members who live and work elsewhere. The local people in the study area belong to the Karanga ethnic group and the main language spoken is Karanga, a dialet of Shona. The poorest families depend on the natural environment for plant resources such as construction timber, firewood and fencing materials, as well as Non-Timber Forest Products (NTFPs) such as insects, mushrooms, wild fruits, vegetables and medicines. Their agricultural practices are essentially subsistence in nature, with land and livestock being the primary household assets. Agricultural mechanization is relatively low, with most farmers using hand tools and oxen for ploughing. Other principal assets include ploughs, ox-drawn carts, wheelbarrows, axes, hoes and the like. Maize (*Zea mays* L.) cultivation is the main activity, with other grains such as sorghum (*Sorghum bicolor* (L.) Moench) and millet (*Pennisetum glaucum* (L.) R. Br.) being planted by most households as insurance against poor rains, which in some years are inadequate to produce a good maize crop. Subsistence grain crops are supplemented by household vegetable production e.g., pumpkins (*Cucurbita maxima* Duchesne ex Lam.), covo (*Brassica carinata* A. Braun), rape (*Brassica rapa* L.), cabbage (*Brassica oleracea* L.) and beans (*Phaseolus vulgaris* L.).

Data collection: Triangulation was the principal method used in collecting data for the present study[24]. Triangulation means looking at the same research phenomenon from more than one source of data. Ethnobotanical data from previous surveys undertaken by Maroyi[19,20,23,25] were used in planning the current study which focused on exotic plant species used as herbal medicines in Shurugwi district. The database generated over the years has a total of 115 exotic plant species that are widely used as food, medicinal, construction material and ornamental purposes. The current study undertaken in Chikato, Donga, Gamwa, Gundura, Hanke, Tongogara and Zvamatenga villages in Shurugwi district (Fig. 1) was conducted between December, 2014 and January, 2015. A snowball technique was used for finding, selecting and inviting participants knowledgeable on medicinal plants[26]. A total of 128 participants took part in this study, with

17 participants and at least one traditional healer per village. Structured and semi-structured interviews were carried out in Shona, a language spoken by all participants. Through interviews with participants, information was collected on the names of exotic plants used for the treatment of human and livestock ailments, the part(s) of plants used, as well as methods of preparation of herbal medicines. During field excursions and field walks with participants, voucher specimens were collected for later identification. All voucher specimens are deposited in the National Herbarium, Harare (SRGH).

Statistical analysis: Statistical Package for the Social Scientists (SPSS) version 21 with $p<0.05$ (5% statistical significance) was used to analyze collected data[27].

RESULTS

Medicinal plant diversity: This study recorded 26 exotic plant species used to traditionally manage various human and livestock diseases in Shurugwi District, Zimbabwe (Table 1). Of these, 22 species (84.6%) have escaped from cultivation occurring as casuals, naturalised or invasive; only *Capsicum annum*, *Mentha spicata*, *Nerium oleander* and *Prunus persica* are still confined to home gardens as food plants or ornamentals. The majority of the plant species used (69.2%) had one or two therapeutic uses. *Bidens pilosa*, *Citrus lemon*, *Datura stramonium*, *Eucalyptus camaldulensis*, *Nicotiana tabacum*, *Psidium guajava* and *Schkuhria pinnata* had at least three therapeutic uses each (Table 1). Dicotyledons were dominant with 25 plant species (96.2%) and a single monocotyledon (3.8%). These medicinal plants were distributed among 15 families and 23 genera. The majority of exotic plants used as traditional medicines in Shurugwi District (57.7%) are from five families (Table 2). Plant families with the highest number of exotic medicinal plants in Shurugwi District were: Euphorbiaceae and Solanaceae (four species each), followed by Asteraceae (three species) and Apocynaceae and Myrtaceae (two species each). Euphorbiaceae and Solanaceae families have the highest number of exotic species used as herbal medicines in Shurugwi District probably because these are large families characterised by several species. The rest of the families were represented by one species each (Table 2).

Growth habit and parts used: Herbs and shrubs were the primary sources of herbal medicines used in Shurugwi District (Fig. 2a). Extensive use of exotic herbs and shrubs in Shurugwi District in preparation of herbal medicines might be linked to their availability as agricultural weeds. The leaves were the most frequently used plant parts, followed by roots, fruits, oil, bark, latex and whole plant (Fig. 2b). The use of whole plant as herbal remedy was administered for herbaceous plant species (Table 1).

Ailments and diseases treated: The majority of exotic plant species used (69.2%) had one or two therapeutic uses and seven species (30.8%) had at least three uses each (Table 1). A total of 21 human and 4 animal ailments were treated with exotic plant species in Shurugwi District (Table 1). Gastro-intestinal disorders, STIs, cold, cough and fever were treated with the highest number of exotic plant species (Table 1).

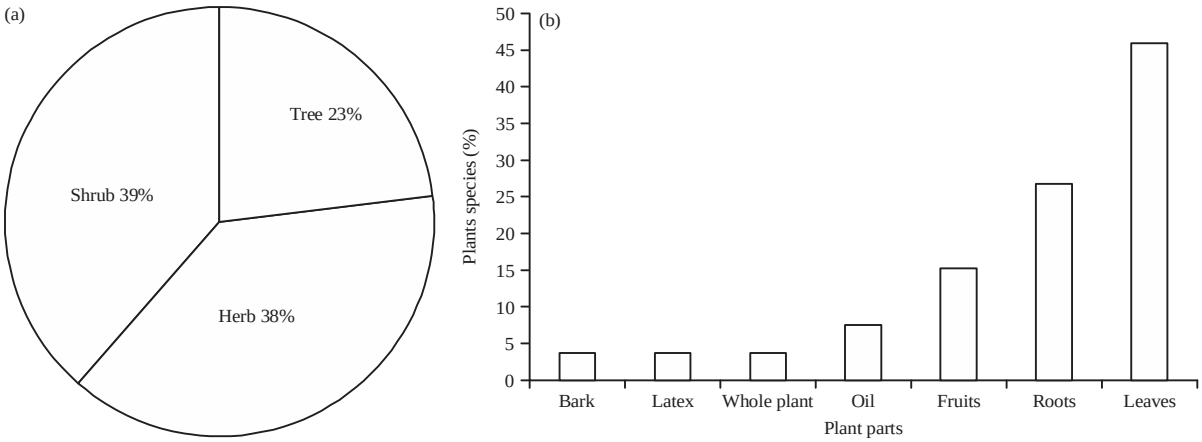

Fig. 2(a-b): Characteristics of exotic plants used as herbal medicines in Shurugwi District, Zimbabwe, (a) Growth form and (b) plant parts used

Table 1: Therapeutical applications of exotic plant species used in traditional medicine in Shurugwi District, Zimbabwe

Family and species names	Vernacular names	Habits	Used parts(s)	Ailment(s) treated, herbal preparation and administration
Agavaceae				
#*Agave sisalana* Perrine	Mukonje	Shrub	Leaves	General body pains, extract taken by mouth
Anacardiaceae				
#*Mangifera indica* L.	Mumango	Tree	Bark	Diarrhoea, extract taken by mouth
Apocynaceae				
#*Catharanthus roseus* (L.) G. Don	Chirindamatongo	Herb	Roots	Diarrhoea, extract taken by mouth
Nerium oleander L.	Oleander	Shrub	Leaves	Sexually Transmitted Infections (STIs), infusion taken by mouth
Asteraceae				
#*Bidens pilosa* L.	Tsine	Herb	Roots	Hypertension, oral thrush and stomach pains, infusion taken by mouth
#*Schkuhria pinnata* (Lam.) Kuntze ex Thell.	Ruhwahwa	Herb	Whole plant	STIs, stomach pains, to cause abortion, infusion taken by mouth
#*Tagetes minuta* L.	Mbanje	Herb	Leaves	Wounds, wounds washed with infusion
Cucurbitaceae				
#*Cucumis anguria* L. var. *anguria*	Muchacha	Herb	Fruits	Snake repellent, fruit pieces left around homestead
Euphorbiaceae				
#*Euphorbia hirta* L.	Mukonde hono	Herb	Latex	Sore eyes, milk latex dropped into eyes
#*Euphorbia tirucalli* L.	Heji	Shrub	Roots	STIs, infusion taken by mouth
#*Jatropha curcas* L.	Munjirimono	Shrub	Oil, roots	Abdominal pains, oil rubbed on painful part, snake bites, dried root powder applied to bitten part
#*Ricinus communis* L.	Mupfuta	Shrub	Oil, roots	Sore eyes, oil applied on sore eyes, toothache, teeth washed with root decoction
Lamiaceae				
Mentha spicata L.	Mentha	Herb	Leaves	Cough and flu, leaves added to tea or hot infusion taken by mouth
Malvaceae				
#*Sida cordifolia* L. ssp *maculata* (Cav.) Marais	Nama	Herb	Roots	Heavy menstruation, infusion taken by mouth
Meliaceae				
#*Melia azedarach* L.	Musiringa	Tree	Leaves	General body pains and STIs, infusion taken by mouth
Moringaceae				
#*Moringa oleifera* Lour	Moringa	Shrub	Leaves, roots	Diarrhoea, leaf extract taken by mouth, toothache, teeth washed with root decoction
Myrtaceae				
#*Eucalyptus camaldulensis* Dehnh.	Mupuranga	Tree	Leaves	Cough, flu and fever, extract drunk with *Citrus lemon* (L.) Burm. f. fruits and *Psidium guajava* L. leaves
#*Psidium guajava* L.	Mugwavha	Tree	Leaves	Cough, flu and fever, extract drunk with *Citrus lemon* fruits and *Eucalyptus camaldulensis* leaves
Rosaceae				
Prunus persica L.	Mupichisi	Tree	Leaves	Diarrhoea, leaf extract taken by mouth
Rutaceae				
#*Citrus lemon* (L.) Burm. f.	Lemoni	Tree	Fruits	Cough, flu and fever, extract drunk with *Eucalyptus camaldulensis* and *Psidium guajava* leaves
Solanaceae				
Capsicum annum L.	Mhiripiri	Shrub	Fruits	*Coccidiosis, macerate given to chicken
#*Datura stramonium* L.	Chowa	Shrub	Leaves	Asthma and STIs, infusion taken by mouth, cough, smoke inhaled while covered with a blanket
#*Nicotiana tabacum* L.	Fodya	Herb	Leaves	Wounds, snuff applied on wounds, *endoparasites, ophthalmia and respiratory problems in livestock, snuff mixed with soot and given to livestock in drinking water
#*Solanum incanum* L.	Nhundurwa	Shrub	Fruits	Ringworm, fruit sap applied on ringworm, snake bite, sap applied on bitten part
#*Solanum lycopersicum* L.	Mutomatisi	Herb	Leaves	Earache, infusion dropped into the ear, *ophthalmia in chicken; chicken made to drink leaf macerate
Verbenaceae				
#*Lantana camara* L.	Mbarambati	Shrub	Roots	Headache, steam inhaled while covered with a blanket

*Veterinary ailments or uses, #Species that have escaped from cultivation and regarded as weeds

Table 2: Families with the largest number of exotic species used as herbal medicines in Shurugwi District, South-central Zimbabwe

Family	No. of medicinal plants	Percentage
Euphorbiaceae	4	15.4
Solanaceae	4	15.4
Asteraceae	3	11.5
Apocynaceae	2	7.7
Myrtaceae	2	7.7

DISCUSSION

The results obtained in this study corroborate those from other countries, demonstrating that exotic plants are important herbal medicines, a fact often overlooked in debates around management of naturalized plant species by governmental agencies and non-governmental organizations. For example, exotic plants are important components of indigenous pharmacopoeias in Bangladesh[13], Brazil[8], Hawai[10], India[14], Kenya[15], Mexico[16] and South Africa[11,12]. According to the current survey, *Bidens pilosa*, *Citrus lemon*, *Datura stramonium*, *Eucalyptus camaldulensis*, *Nicotiana tabacum*, *Psidium guajava* and *Schkuhria pinnata* are among the widely used herbal medicines in South-central Zimbabwe. These seven species appear to be an important component of the Southern African indigenous pharmacopoeia as the species have also been reported as some of the exotic plant species used as herbal medicines in the Limpopo province of South Africa[11]. The present study also found the majority of exotic plants used as herbal medicines to belong to Apocynaceae, Asteraceae, Euphorbiaceae, Myrtaceae and Solanaceae families. Similar results were obtained by Rahman and Roy[13], who found the majority of invasive alien plants used as herbal medicines in Bangladesh to be from Asteraceae, Convolvulaceae and Fabaceae with four species each, followed by Verbenaceae with three species and Amaranthaceae, Lamiaceae, Myrtaceae and Polygonaceae with two species each.

Human diseases and ailments treated by the highest number of exotic plants were gastro-intestinal disorders, sexually transmitted infections, cold, cough and fever. Gastro-intestinal disorders, particularly cholera, diarrhoea and dysentery are a major concern not only in Shurugwi District but the whole country[20] and in Mozambique where dysentery and cholera usually result in high mortality rate if not treated promptly[28]. Sexually transmitted infections are a major public health concern in developing countries with their transmission rate regarded as one of the highest in the world[29]. Sexually transmitted infections are one of the most common reasons for people to use herbal medicines and visit traditional healers in Zimbabwe[17-20].

CONCLUSION

Exotic plants used as herbal medicines were assessed through semi-structured interviews, personal observations and guided field walks with community members and traditional healers. Results of this study showed that local communities in South-central Zimbabwe have enriched their indigenous pharmacopoeia through utilization of exotic and weedy plant species as herbal medicines. This is reflected in 26 exotic plant species used for treating and managing human and livestock diseases and ailments. Based on the results of this study, it can be concluded that exotic plant species play an important role in the provision of primary healthcare to local communities in South-central Zimbabwe. The use of exotic plants as herbal medicines in South-central Zimbabwe is mainly due to their medicinal value and the fact that they are readily available in home gardens and adjacent areas.

Future recommendation: The documented rich ethnobotanical knowledge and repository of medicinal plants reinforces the need for an evaluation of the bioactive compounds responsible for the *in vitro* and *in vivo* pharmacological effects and their mode of action. Further investigations on phytochemical constituents and subsequent screening are needed for opening new opportunities to develop pharmaceuticals based on herbal medicines.

SIGNIFICANCE STATEMENT

This study revealed that exotic plant species are used as herbal medicines in South-central Zimbabwe, forming an important component of the indigenous pharmacopoeia. Results from the current investigation will help the future researchers to document use of exotic plants as substitute herbal medicines for scarce indigenous medicinal plants in other regions of the world.

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