Ethnomedicinal uses of exotic plant species in Mogalakwena Municipality of Waterberg District, Limpopo Province South Africa

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ABSTRACT

Traditional medicine still constitutes a large part of the primary health care sector in South Africa. However, limited information exists about the ethnomedicinal uses of exotic plant species. Thus an ethnobotanical survey was conducted to investigate its use in Mogalakwena Local Municipality of Waterberg District of the Limpopo Province, South Africa. This was done by interviewing 30 traditional health practitioners, from 15 villages between April and November 2015. The study documented 8 exotic plant species that are used to treat various diseases. The documented species are distributed across 7 families, of which the Asteraceae (2) is the most prominent, while the remaining families are represented by single species. The plant parts, most used was roots (36.4%), followed by fruits (27.3%), whole plant (18.1%), whereas leaves and flower contributed 9.1% each. It was further evidenced that preparation of remedies were mainly through infusions (30%) and decoctions (30%), administered orally. It is concluded that exotic plants now form an integral part of the materia medica of Bapedi traditional health practitioners. It is further concluded that with proper and careful management exotic plant species can reduce overexploitation of heavily harvested indigenous medicinal plants in South Africa.

Keywords:
Ethnobotanical survey, medicinal plants, tradition health practitioners and Conservation.

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INTRODUCTION

Throughout history, plants have been used as the source of medicinal agents to treat diseases and to relieve physical suffering. The use of plants in traditional medicine is still common and widespread in Africa (Shale et al., 1999). This is because despite the current sophisticated therapeutic agents developed from modern drug discoveries, traditional medicine is seen as the more accessible and affordable by people in developing countries (Truter, 2007). It is estimated that over two-thirds of Africans and other developing countries rely on traditional medicine for primary health care (WHO, 2002).

An estimated 10% of indigenous plant species in South Africa are threatened as results of unsustainable harvesting practices (Williams et al., 2013). Some of these species have been exploited to such an extent that they are seldom found in unprotected areas (Wiersum et al., 2006). This in turn results in difficulties for traditional health practitioners in treating some of the ailments. Thus, according to Street and Prinsloo (2012) there is a need for an alternative supply of medicinal plant material.

South Africa is estimated to have more than 8500 exotic plants, with some of these being increasingly utilized by traditional health practitioners for primary health care (Wojtasik, 2013). The term exotic plants refer to plants that are distributed outside their native region, but they are not invasive in nature. The distribution of exotic plants may occur unintentionally or intentionally by human activities. Unintentional introduction of exotic plants can results via road corridors (Christen and Matlack, 2008) and railways lines Hulme (2009). However, most of exotic plants are intentionally introduced for economic reasons, especially for foods, horticultural, and forestry purposes (Jacobs et al., 2014).

Wilson et al. (2013) reported that more than 750 exotic tree species and 8000 exotic shrubby and herbaceous species occur in South Africa. Exotic species are estimated to have invaded almost 10 million hectares (8.28%) in South Africa (Wilson et al., 2013). This has resulted in biodiversity decline; impaired ecosystem services and have negative impact on human wellbeing (Pyšek and Richardson, 2010). However, not all exotic plants have negative impact in biodiversity.

Wojtasik et al. (2013) noted that more than 300 exotic plants are used medicinally and are traded in South African markets. This is mainly because they are widespread and are easily accessed by traditional health practitioners on communal lands and in home gardens (Maroyi, 2006). Ethnomedical uses of exotic plants sometimes serve as substitute for scarce indigenous plants (Wojtasik, 2013). In areas of high ecological disturbances, with high level of infestation, the extent of use of exotic species can be high. For example, Thring and Weitz (2005) noted that 33% of ethnomedical plants used in Elim region of the Western Cape Province in South Africa are exotic. Maema et al. (2016) documented exotic plant of Mogalakwena Local Municipality that are invasive in nature. No reports on the medicinal usage of the exotic plant species in Waterberg district have been reported in the available literature. Therefore this study was conducted to determine medicinal uses of exotic plants by Bapedi traditional health practitioners in Mogalakwena Local Municipality.

MATERIALS AND METHODS

Study area and demographics

The study was conducted in the Mogalakwena Municipality of the Waterberg District, Limpopo Province, South Africa (Figure 1). Geographically, Mogalakwena Municipality lies between 23°10′−24°20′S and 28°10’−29°10′E (BGIS.Sanbi.org). The municipality host 614 139 people, with black Africans the dominant group, comprising 90% of the population. Poverty due to high levels of unemployment still remains a major challenge in this area. Consequently, the majority of the people rely primarily on agricultural and subsistence farming activities to meet their livelihood needs (Stats SA, 2012).

Ethnobotanical survey

Data was collected from April 2015 to November 2015 in 15 local villages within the study area. Two Bapedi (the dominant cultural group) traditional healers per village were selected via the convenient sampling method, resulting in 16 females and 14 male healers been interviewed. Respondents were of between 25 and 70 years old. Data was collected using a semi-structured questionnaire using the face-to-face interview technique as described in similar studies (Akay-
din, 2013; Seid and Aydagnehum, 2013), supplemented with guided field tours with traditional healers to verify the species names and collect voucher specimens. Information such as vernacular name, source of plants collection, plant part(s) used, ailments treated (Table 1), as well as preparation methods (Figure 3) and dosage were documented.

**Plant collection and identification**

Voucher specimens, as pointed out by accompanied traditional healers, were collected from home gardens and communal areas. Plant species were initially identified by their vernacular names (Table 1). Later, taxonomic identification was done by a trained taxonomist at the Larry Leach Herbarium (UNIN) of the University of Limpopo.

**Statistical analysis**

The data was captured in Microsoft Excel 2010. A descriptive statistic procedure like percentage and frequency distribution were employed for data analysis.

**Ethical considerations**

A permit was requested and obtained from various traditional councils within the Mogalakwena Municipality to conduct research within the area of jurisdiction and to meet with traditional healers in order to request them to participate in the study. Each traditional healer was requested to sign a consent form as approved by the University of Limpopo ethics committee. As such all ethics related to people’s privacy, confidentiality, anonymity, were observed, adhered to and respected. Participants in this study were voluntary, and participated freely and anonymously. The sources of primary and secondary data and information are acknowledged.

**RESULTS**

**Plant diversity**

The current study documented 8 exotic plants that are used by Bapedi traditional health practitioners in Mogalakwena Local Municipality. Two exotic plants namely *Tagetes minuta* and *Bidens pilosa* belong to the family Asteraceae and all other families are represented by single species (Table 1).

The predominant plant life forms used was trees (50%), followed by shrubs and herbs, with each contributing 25%.

**Plant parts used**

The most used plant parts were roots (36.4%), followed by fruits (27.3%), whole plant (18.1%), with leaves and flower each contributed 9.1% to total usage.

**Ailments treated**

The reported exotic plant species are used to treat 9 different ailments. The reported ailments are of gynaecological in nature (womb cleaner as a result of miscarriage), a sexually transmitted infection (gonorrhoea), skin related ailment (wounds and skin rush), gastrointestinal disorders (dysentery and diarrhoea), cardiovascular (Heart failure and blood purifier), and respiratory ailments (cold and Flu). It is important that *Tagetes minuta* was also applied in ethnoveterinary to control nematodes and ticks in livestock.

About 75% of the above mentioned ailments were treated using a single plant species, except in two incidences were cold and flu is treated, two plant species *Moringa oleifera* and *Citrus lemon* are used. *Agave angustifolia* and *Carica papaya L* were also used to treat gonorrhoea.

**Plant extraction**

Bapedi traditional healers use various protocols for plant extraction. Preparation was mainly through infusions and decoctions, each preparation accounting for 30% of the total methods employed. It was further noticed that squeeze, burning and paste contributed 10% each.

**Mode of administration**

Only two modes of administration were encountered. The prepared extract was prescribed orally (73%) whereas topical application was the preferred (37%) mode of administration for skin related ailments (wounds and skin rush).

**Discussion**

**Plant diversity**

Eight exotic plants were documented in *materia medica* of Babedi traditional health practitioners in Mogalakwena Local Municipality (Table 1).
Figure 1: Study area

Figure 2: Plant parts used
The low diversity of exotic plants in the study area can be linked to the varying spreading pattern as well as ethnomedicinal knowledge towards exotic plants. Most of the documented exotic plants were cultivated (75%). According to Foxcroft et al. (2008) most exotic plant are cultivated in home gardens and consequently escape to natural systems.

The family Asteraceae is represented by two herbaceous plants (Bidens pilosa and Tagetes minuta) that are widespread in tropical and sub-tropical regions (Deba et al., 2008; Senatore et al., 2004). In South Africa, B. pilosa and T. minuta are common weedy plants that grow mostly in unwanted places such as cultivated land, disturbed areas and roadsides. The use of B. pilosa and tagetes minuta by Bapedi traditional health practitioners can be ascribed to its abundance in the study area, as are common weedy plants that are found in cultivated and disturbed area. Carica papaya L., Musa acuminata and Punica granatum are not only used for medicinal purposes but also used as nutritional plants for rich source of vitamin C (Valente et al., 2011) and are cultivated in the study area. Agave angustifolia is cultivated for ornamental purpose in most of the study area. The plant species Citrus lemon is cultivated for its fruit that is used as flavour additive and it is widely known to treat cold and flu. Mosina et al. (2014) noticed that most of the garden plants in the remote and rural areas are cultivated for fruit, vegetables, medicinal as well as for ornamental purposes.

**Plant parts used**

The preference for roots is mostly due to the high content of medicinal properties (Semenya et al., 2012) and local accessibility. However, there is significant use of fruit (27%) as a plant part by Bapedi traditional health practitioners to treat different ailments. This is unusual because fruit are seasonal as compared to other plants parts. Despite high medicinal uses of fruit (27%) from exotic plants, the fruit are also consumed for their nutritional value. Fruit harvested from Musa acuminata (Banana tree) forms multimillion industries in tropical and subtropical regions for commercial production (Anyasi et al., 2013).

**Ailments treated**

This study reports treatment of gonorrhoea using two plant species namely Carica papaya and Agave angustifolia (Table 1). Gonorrhoea is one of the most widespread contagious infections in the world (Mulaudzi et al., 2015). The medicinal use of Carica papaya for treatment of gonorrhoea is reported in different regions of South Africa and elsewhere. Semenya et al. (2012) reported the use of C. papaya for treatment of gonorrhoea by Bapedi traditional health practitioners in Limpopo Province of South Africa. Lay people in Mpumalanga Province also use Carica papaya for gonorrhoea (De Wet et al., 2011). The use of C. papaya in gonorrhoea treatment is important, especially for people residing in rural areas where exotic plants are widespread and easily accessed as opposed to unavailable modern health care facilities and declining indigenous medicinal plants. The common use of C. papaya by different ethnic groups suggests that this plant species might contain secondary metabolites that can inhibit pathogens of sexually transmitted infections. Antibacterial essays have demonstrated broad-spectrum activity against STI pathogens (Naidoo et al., 2013).

Agave angustifolia is also documented for treatment of gonorrhoea. Root decoction is prepared and administered orally. As far as literature search, there is no record of treatment of gonorrhoea using A. angustifolia. The medicinal use of A. angustifolia warrant further investigation.

**Bidens pilosa**, an aggressive weedy species found growing in disturbed and cultivated area of most South African land. The species have been documented for medicinal uses in South Africa (Lewu and Afolayan, 2009; Semenya et al., 2012). In this study, a root from B. pilosa is combined with whole plant of Dicerocaryum eriocarpum to prepare decoction to clean womb after birth or after miscarriage (Table 1). The combination of plants might be linked to enhancement of the efficacy of remedy. Plant extract mostly contains broad mixture of compound that work synergistically to regulate infections and therefore plant might not work alone (Lewis and Ausubel, 2006). Semenya et al (2012) noted the use of B. pilosa for treatment of menstrual disorder among Bapedi healers in Limpopo Province. Leaf or root infusion from Bidens pilosa is used by Xhosa tribe in Eastern Cape of South Africa for stomach pains (Lewu and Afolayan, 2009). Rojas et al. (2006) noticed water extracts of B.
pilosa to have higher activity against *Bacillus cereus* and *Escherichia coli* than organic solvents. This finding validates the traditional preparation for gastrointestinal disorder noted by Lewu and Afolayan (2009) for stomach pains. Lewu and Afolayan (2009) noticed that exotic plants were mostly used by Xhosa tribe in Eastern Cape of South Africa to treat gynaecological ailments. Therefore, ethnomedicinal uses of exotic species like *B. pilosa* could help to clean womb after birth.

The whole plant from *Tagetes minuta* is ground to fine powder for treatment of wounds (Table 1). Babedi traditional health practitioners use the same preparation protocol to control nematode and ticks in livestock. Although, Kenyans people prepare decoction from *T. minuta* to control ticks, this preparation method is helpful for people in rural areas to protect their livestock (Njoroge and Bussmann 2006). This plant has been validated *in vivo* in ethnoveterinary remedies to control ticks (Nchu et al., 2012; Andreotti et al., 2013). *T. minuta* is important in ethnomedicine for treatment of wounds and other ailments. Abbasi et al., (2010) documented the application of *T. minuta* for wounds by tribal people of North-West Frontier Province in Pakistan. In East Africa, *T. minuta* is used for stomachache; Toothache as well as wounds treatment (Njoroje et al., 2004). It can be concluded that ethnomedicinal records of *T. minuta* and *in vivo* studies from various regions validate treatments for wounds and nematode control by Babedi traditional health practitioners.

*Moringa oleifera* is documented for treatment of blood cleansing, cold and flu in our study (Table 1). Dried leaves or fruit/pods are grounded to fine powder and infusions are prepared. The ethnomedicinal use of *M. oleifera* for treatment of cold and flu corroborates the findings of Ramalingum and Mahomoodally (2014). Babedi healers prepare crude extracts from *Moringa* pods or leaves through infusions prior to oral administration. This method of traditional preparation might extract secondary metabolites that include alkaloids and morigine that are important in respiratory infections (Flora and Pachauri, 2011). *Moringa* is gaining popularity both in nutrition and medicinal research due to its high nutritional values and ethnomedicinal uses (Silva et al., 2014). Most studies report *Moringa* in ethnomedicine to treat multiple ailments including the ones reported in this study (Silva et al., 2014). For example, *Moringa* is reported as stimulant in para lytic afflictions and can also act as a cardiac or circulatory tonic (Anwar et al., 2007). This finding is in agreement with our finding with regard to blood cleansing (Table 1). However the report of Anwar et al., (2007) makes use of roots as plant parts while our study use leaves or pods.

Gastrointestinal infections such as dysentery and diarrhoea are treated with *Punica granatum*. According to the world Health Organization, intestinal infections account 3−4 million deaths annually, especially to young people (WHO, 1996). The ethnomedicinal use of *P. granatum* for intestinal infections is common in Limpopo Province of South Africa (Semenya et al., 2012) and elsewhere (Pradeep et al., 2008). Either fruit or roots are used for preparation of remedy. Anti-diarrhoeal activities of *Punica granatum* has been confirmed *in vitro* (Mathabe et al., 2006).

*Musa acuminata* is documented for heart fail and skin rush. Babedi traditional healers slices banana flower to prepare infusion for treatment of heart fail. Orhan, (2001) noted that soluble and insoluble fibres fractionated from banana pulp had a cholesterol-lowering effect. Furthermore, the reported finding noted that freeze-dried banana pulp was responsible for lowering cholesterol while this study noted the use of the flower. *Musa paradisiaca* and *Musa sapientum* showed the cholesterol lowering effect (Usha et al., 1989; Ercan et al., 1993). High cholesterol can lead to cardiovascular problem such as heart fail. Plant species within same taxa are characterised by similar chemical compounds (Wink M, 2003). This might apply to locally grown and medicinally used banana tree known as *M. acuminata*.

A banana peel is burnt, crushed and mixed with Vaseline™ to apply on rushed skin. No information is been found in literature with respect to ethnomedicinal use of Banana peel for skin rush treatment. The ethnomedicinal use of banana peel warrant further investigation for validity. This information also needs to be validated through antibacterial assays and phytochemical analysis.

**Plant extraction and mode of administration**

Bapedi traditional healers employed various protocols for plant extract. However, in case of
exotic plants, preparation was mainly through infusions and decoction, each preparation accounted 30%, it was further noticed that burning, chew, paste and squeeze contributed 10% each.

Preparation methods do not depend on whether plants are exotic or indigenous. Infusions and decoctions are favoured as the method of plant extraction. The high preference of decoction (30%) and infusions (30%) is in agreement with other ethnomedicinal studies based on exotic plants (Semenya et al., 2012), as well as ethnomedical uses of indigenous plants (Njoroge and Bussmann, 2009). Some of the noticed extraction procedure includes fruit squeeze, burning and past (Figure 3). These are common preparation methods employed by traditional healers in South Africa (De Wet et al., 2012) and other parts of Africa (Igoli et al., 2005; Ribeiro et al., 2010; Shanmugam et al., 2009). Preparations of plant extract were (87.5%) from single plant species. Of all 8 exotic plants documented, B. pilosa is the only plant species that is used in combination with whole plants of Diceroscaryum eriocarpum (indigenous problem plant) to prepare decoction for womb cleaning.

Only two mode of administration was documented in this study. Most plants extract are taken orally (77%) when contrasted with topical mode (23%). Preference of oral administration could be simplicity in absorption. Semenya et al. (2013) noted that oral administration allow quick absorption of metabolites through human intestine. Topical mode was method advocated for skin related ailments such as skin rush and wounds. This also provides a direct method of treatment on affected area. Ribeiro et al., (2010) also noticed oral and topical modes are mostly used administration mode in district of Massingir, Mozambique.

Role of exotic plants in the local medical systems

The exotic plants are now widespread in natural and semi-natural systems of South Africa and other countries. Various habits of plants from all taxonomic groups are introduced in native flora of South Africa. Many of exotic plants are incorporated into metaria medica of local traditional health practitioners. Therefore, traditional medicinal in South Arica cannot be static system that does not change. Exotic plants have found relevance in traditional medicine system of South Africa because some of exotic plants are used medicinally by local traditional health practitioners (Lewu and Aflolayan 2009). Today more than 300 exotic plants are used medicinally and some are traded in South African market (Wojtasik, 2013). According to Alencar et al. (2014) the role of exotic plants possesses two important actions. They could firstly provide alternative form of medicine and maintain local medicine system through preservation of therapeutic indications. Secondly they provide therapeutic indications that other indigenous plants cannot perform. In Eastern Africa, exotic medicinal plants are domesticated as part of increasing the income and availability of medicinal plants to traditional health practitioners (Njoroge et al., 2004).

Conclusions

Bapedi traditional health practitioners in Mogalakwena Local Municipality utilise exotic plant species for primary health care. This information could further help traditional health practitioners elsewhere to enhance primary health care. The ethnomedicinal record of exotic plants can be used for in vitro studies for drug development.

A sustainable use of indigenous plants is of a great concern in South Africa. Exotic plants are widespread in natural and semi-natural system of South Africa and are becoming integrated into materia medica of Bapedi tradition health practitioners. An ethnobotanical study on substitutions of indigenous plant species with exotic plant species is recommended. This could lead to better natural resource management for sustainable use of some of the scarce and endangered indigenous plant species. In conclusion, exotic plant species are becoming important source of medicinal plants in Limpopo Province and their documentation is recommended as an alternate medicinal plant material.

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Table 1: Exotic plants used medicinally for various diseases in Mogalakwena Local Municipality

| Family       | Scientific name         | Voucher numbers | Parts used | Habit | Traditional uses | Preparation method | Mode of administration |
|--------------|-------------------------|-----------------|------------|-------|------------------|--------------------|-----------------------|
| Agavaceae    | Agave angustifolia L.    | UNIN 12299      | Roots      | Shrub | Gonorrhoea       | Infusion           | Orally                |
|              | B. pilosa + D. eriocarpum | UNIN 12205      | Roots + Whole plant | Herb | Womb cleaner miscarriage | decoction | Orally                |
| Asteraceae   | Tagetes minuta          | UNIN 12217      | Whole plant | Herb | Wounds and Veterinary | Paste             | Topically              |
| Caricaceae   | Carica papaya L.        | UNIN 12273      | Roots      | Tree  | Gonorrhoea       | Decoction          | Orally                |
| Moringaceae  | Moringa oleifera Lam.   | UNIN 12223      | Fruit and Leaves | Tree | Blood cleaning, cold and flu | Infusions       | Orally                |
| Musaceae     | Musa acuminate L.       | UNIN 12328      | Flower     | Shrub | Heart fail       | Infusion           | Orally                |
|              |                         |                 | Fruit peel |       |                  |                    |                       |
| Punicaceae   | Punica granatum         | UNIN 12293      | Fruit/roots | Tree | Diarrhoea and dysentery | Decoction prepared from roots. Dried or fresh fruit / chew | Orally                |
| Rutaceae     | Citrus lemon            | UNIN 12327      | Fruit      | Tree  | Flu and cough    | Squeeze            | Orally                |

Figure 3: Method of preparation
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