



Ethnopharmacological communication

Medicinal plants used for the treatment of diarrhoea in northern Maputaland, KwaZulu-Natal Province, South Africa

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ABSTRACT

Aim of the study: To document the ethnobotanical knowledge on antidiarrhoeal plant use by lay people in a rural community in northern Maputaland.

Materials and methods: Interviews were conducted amongst homestead inhabitants, using structured questionnaires. The focus was on the medicinal plants which are growing in and around the immediate vicinity of the homesteads.

Results: Twenty-three plant species are used in the study area to treat diarrhoea. Four plants (*Acacia burkei*, *Brachylaena transvaalensis*, *Cissampelos hirta* and *Sarcostemma viminale*) are recorded for the first time globally as an antidiarrhoeal. The three antidiarrhoeal plants most frequently used in the study area are *Psidium guajava*, *Catharanthus roseus* and *Melia azedarach* (all three are exotic to South Africa), followed by *Sclerocarya birrea* and *Strychnos madagascariensis* which are indigenous. Seven of the 23 plant species are used in five different plant combinations for increased antidiarrhoeal efficacy.

Conclusion: The wide variety of plants that are used to treat diarrhoea in this area supports the traditional value that medicinal plants have in the primary health care system of the rural people in northern Maputaland, KwaZulu-Natal.

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1. Introduction

World-wide, nearly nine million children (under the age of five years) die every year as a result of diarrhoea (WHO, 2009). An estimated 88% of diarrhoeal-related deaths are caused by inadequate sanitation and poor hygiene. Chronic diarrhoea is also related to HIV/AIDS conditions, as immunocompromised infected people are susceptible to opportunistic infections. South Africa is one of the highest HIV infection rates in the world, with KwaZulu-Natal being the worst affected province (Thurlow et al., 2009). Furthermore, northern Maputaland is one of the most poverty stricken areas in South Africa, where the availability of clean drinking water, lack of education and sanitary ablutions are particularly problematic (Municipal Demarcation Board South Africa, 2001). Under these conditions diarrhoea is a major concern to resident rural communities.

A study on traditional remedies around the Eastern Cape region of South Africa demonstrated that diarrhoea was one of the most prominent diseases treated with traditional medicines (Dambisya

and Tindimwebwa, 2003). It is known that antidiarrhoeal plant extracts have antispasmodic properties, delay gastrointestinal transit, suppress gut motility, stimulate water adsorption and/or reduce electrolyte secretion (Palombo, 2006). Studies done on the ethnobotanical use of antidiarrhoeal plants in South Africa have mostly focused on information obtained from traditional healers and that found in the literature (Lin et al., 2002; Mathabe et al., 2006; Appidi et al., 2008; Fawole et al., 2009). Presently, only two studies have focused on rural dwellers in South Africa. One such study was conducted in the Eastern Cape Province (Appidi et al., 2008) and a case study was restricted to the Mbazwana area (northern Maputaland) where ten homesteads were approached (De Wet et al., 2008). The latter study revealed 12 plants species that are used to treat diarrhoea. Both studies emphasised that medicinal plants play an important role in the primary health care of rural people, that there was a need to continue with these types of studies and that there is still a wealth of undiscovered ethnobotanical information to be documented in this remote area of KwaZulu-Natal (De Wet et al., 2008).

As many of the rural people in the study area are illiterate or semi-illiterate, the knowledge on plant use is often restricted to verbal communications only. A study by Zobolo and Mkabela (2006) in northern KwaZulu-Natal has found that the younger generation regards indigenous knowledge as primitive. While having the writing skills, the youth have shown little interest in the documentation

Abbreviations: AIDS, acquired immunodeficiency syndrome; HIV, human immunodeficiency virus; WHO, World Health Organization.

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of medicinal plant use. It has thus become important to systematically document the traditional medicinal knowledge of plants with therapeutic value as it can disappear with time as a result of naturally occurring mortality. The importance of lay knowledge on the use of medicinal plants is further stressed by a study done by Dahlberg and Trygger (2009) in the community of Mnqobokazi, in the north-western part of the Mkuze wetlands on the coastal plain of KwaZulu-Natal. This area focused on the overall medicinal plant knowledge in this area and the role it plays in the community's primary health care.

2. Materials and methods

2.1. Study area

The study area (Fig. 1) is situated between 32°22' and 32°52' latitudes and 27°15' and 27°30' longitudes in northern Maputaland, KwaZulu-Natal, South Africa. This area consists of a few vegetation types with a high concentration of endemism (Scott-Shaw, 1999). Each of the four selected regions are dominated by a different types of vegetation, namely: the Tembe Sandy Bushveld type (Tshongwe), the Maputaland Coastal Belt type (Mseleni), the Northern Coastal Forest (Mabibi) and the Maputaland Wooded Grass Land type (Mbazwana) (Mucina et al., 2005). A total of eighty homesteads (Muzis) were visited, 20 per region. These regions are all situated in the Umkhanyakude District Municipality, at Umhlabuyalingana Local Municipality. It is a very poor region with 45% households not having any formal income. Only 4% of the households have flushable toilets, and approximately 69% households have no sanitation. Thirty-three percent of the households do not have access to piped water. The community depends on boreholes, springs, rainwater tanks, dams, pools and river water for a continuous water supply (Municipal Demarcation Board South Africa, 2001).

2.2. Ethnobotanical survey

An ethnobotanical study of antidiarrhoeal plants was conducted during February–March 2008. Ethics clearance was obtained from the University of Zululand before the onset of the study. Household residents were approached and the objective of the study was explained in IsiZulu. Households in each of the four regions were selected purposively, based on the resident's medicinal plant knowledge and attitudes towards sharing their knowledge (Tongco, 2007). A form of consent was signed before interviews were conducted, using a structured questionnaire. The following ethnobotanical data was obtained: locality, sociodemographic data (age, gender and educational background), vernacular plant names, plant parts used, method of preparation, dosage forms and method of administration. The focus of the study was to determine which plants growing in and around their homesteads are being used to treat diarrhoeal infections. Plant species documented in the survey were collected during February and March 2008, identified and voucher specimens are deposited in the herbarium of the Department of Botany, University of Zululand, South Africa. Identity of plant samples was authenticated by Mkiphene Ngwenya from the South African National Biodiversity Institute KwaZulu-Natal Herbarium.

3. Results

The survey documented 23 plant species (15 families) which were used to treat diarrhoea by the rural people in the study area (Table 1). All the plants collected were growing either in the homesteads or in the peripheral area of the homestead and are available all year round. Table 2 gives the status of natural distribution of

Table 1
Plant species used for the treatment of diarrhoea.

Plant species, voucher number	Local name	Family
<i>Acacia burkei</i> Benth (MNN-3) ^a	Umkhaya	Fabaceae
<i>Acanthospermum glabratum</i> (DC) Wild (MNN-37)	Inamathela	Asteraceae
<i>Brachylaena transvaalensis</i> E. Phillips & Schweick. (MNN-30)	Iphahlalehlathi	Asteraceae
<i>Catharanthus roseus</i> (L.) G. Don. (MNN-7)	Imbali, Ikhwinini	Apocynaceae
<i>Chenopodium ambrosioides</i> L. (MNN-39)	Unukani, Ikhambi	Chenopodiaceae
<i>Cissampelos hirta</i> Klotzch (MNN-27)	Umanyokane	Menispermaceae
<i>Garcinia livingstonei</i> T. Anderson (MNN-19)	Umphimbi	Clusiaceae
<i>Gymnosporia senegalensis</i> (Lam.) Loes. (MNN-13)	Ubhlangwe	Celastraceae
<i>Krauseola mossambicina</i> (Moss.) Pax & K. Hoffm. (MNN-6)	Isihlaza, Isihlazi	Caryophyllaceae
<i>Lippia javanica</i> (Burm.f.) Spreng. (MNN-20)	Umsuzwane	Verbenaceae
<i>Mangifera indica</i> L. (MNN-29)	Umango	Anacardiaceae
<i>Melia azedarach</i> L. (MNN-4)	Umsilinga	Meliaceae
<i>Psidium guajava</i> L. (MNN-5)	Ugwava	Myrtaceae
<i>Sarcostemma viminale</i> (L.) R. Br subsp. <i>viminale</i> (MNN-11)	Umbelebele, Ingotshwa	Apocynaceae
<i>Schotia brachypetala</i> Sond. (MNN-25)	Umngxamu	Fabaceae
<i>Sclerocarya birrea</i> (A. Rich.) Hochst. subsp. <i>caffra</i> (Sond.) (MNN-12)	Umganu	Anacardiaceae
<i>Senna occidentalis</i> (L) Link (MNN-2)	Ikhoshokhoshu	Fabaceae
<i>Strychnos madagascariensis</i> Pior. (MNN-9)	Umkwakwa	Strychnaceae
<i>Syzygium cordatum</i> Hochst. ex. C. Krauss. (MNN-36)	Umdoni	Myrtaceae
<i>Terminalia sericia</i> Burch. ex DC. (MNN-16)	Ikonono	Combretaceae
<i>Trichilia emetica</i> Vahl (MNN-35)	Umkhuhlu	Meliaceae
<i>Vangueria infausta</i> Burch. subsp. <i>infausta</i> (MNN-38)	Umviyo	Rubiaceae
<i>Vernonia natalensis</i> (DC) Sch. Bip. ex. Walp (MNN-33)	Uhlambihlohane, Isibhaha	Asteraceae

^a MNN = MN Nkwanyana.

each plant species, the number of time(s) the plant was quoted for its antidiarrhoeal usage, plant parts used, the preparation method, the dosage of the medicine prepared and some of its reported antidiarrhoeal usage. To the best of our knowledge, *Acacia burkei*, *Brachylaena transvaalensis*, *Cissampelos hirta* and *Sarcostemma viminale* are recorded for the first time globally as medicinal plant antidiarrhoeal treatments. Although the above mentioned plant species do not have any recorded diarrhoeal uses they are being used medicinally for the treatment of other ailments (Watt and

Table 2
Plant species used for the treatment of diarrhoea by a rural community in northern Maputaland.

Plant species	Number of households	Type of plants	Status of plant	Part used	Preparation	Reported anti-diarrhoeal usage
<i>Acacia burkei</i> ^a	4	Tree	Wild	Bark or leaves	Bark or leaves are crushed and mixed with cold or hot water. The infusion (125 ml) is administered twice a day until diarrhoea subsides.	None found
<i>Acanthospermum glabratum</i> ^b	6	Herb	Wild	Whole plant	The whole plant is crushed and mixed with warm water. The infusion (10 ml) is drunk three times a day by children and 60 ml (a quarter of a cup) 3 times a day by adults. It can be administered anally; dosage depends on the person's weight.	Root, leaves (Botsaris, 2007)
<i>Brachylaena transvaalensis</i> ^a	3	Tree	Wild	Bark or leaves	Bark or leaves are crushed and mixed with cold or hot water. The infusion (125 ml) is drunk twice a day until diarrhoea subsides. It can be administered anally; dosage depends on the person's weight.	None found
<i>Catharanthus roseus</i> ^b	22	Herb	Wild	Root, stem or leaves	Roots, stems or leaves are crushed and mixed with cold or hot water. A teaspoon (5 ml) of the infusion is drunk twice a day until diarrhoea subsides.	Root, leaves (De Wet et al., 2008)
<i>Chenopodium ambrosioides</i> ^b	4	Herb	Wild	Whole plant	Is used mainly for children. The whole plant is crushed and mixed with cold, warm or hot water. The infusion is administered orally or anally. Orally, 60 ml two times a day, until the diarrhoea subsides.	Whole plant (DeFilipps, 2004)
<i>Cissampelos hirta</i> ^a	2	Herb	Wild	Whole plant or root	Plant or roots are crushed and mixed with coldwater. The infusion (60 ml) is administered orally twice a day, until diarrhoea subsides.	None found
<i>Garcinia livingstonei</i> ^a	4	Tree	Wild	Root or bark	Roots or bark are crushed and mixed with warm or hot water. This is administered orally or anally. Infusion (125 ml) is drunk three times a day, until the diarrhoea subsides.	Kaikabo et al. (2008)
<i>Gymnosporia senegalensis</i> ^a	6	Tree	Wild	Leaves	Leaves are either chewed or crushed and mixed with cold water. The infusion (60 ml) is drunk three times a day, until the diarrhoea subsides.	Root (Irvine, 1961; Hutchings et al., 1996; Mathabe et al., 2006)
<i>Krauseola mosambicina</i> ^a	7	Herb	Wild	Whole plant	The whole plant is crushed and mixed with cold water. A quarter of a cup (60 ml) is taken anally or orally two times a day, until the diarrhoea subsides.	Whole plant (De Wet et al., 2008)
<i>Lippia javanica</i> ^a	1	Shrub	Wild	Leaves	Leaves are crushed and mixed with cold or hot water. The infusion (60 ml) is drunk twice a day, until the diarrhoea subsides.	Leaves (Hutchings et al., 1996; Njoroge and Kibunga, 2007)

Table 2(Continued)

Plant species	Number of households	Type of plants	Status of plant	Part used	Preparation	Reported antidiarrhoeal usage
<i>Mangifera indica</i> ^b	1	Tree	Cultivated	Leaves	Leaves are crushed and boiled with water. The infusion (60 ml) is drunk twice a day, until the diarrhoea subsides.	Leaves (Njoroge and Kibunga, 2007), stem, seeds (DeFilipps, 2004), cotyledons (Joshi and Joshi, 2000)
<i>Melia azedarach</i> ^b	20	Tree	Cultivated	Leaves	Leaves are crushed and mixed with cold water. The infusion (125 ml) is drunk twice a day, until diarrhoea subsides.	Bark, fruit, seed (Suresh et al., 2008), leaves (Suresh et al., 2008; De Wet et al., 2008)
<i>Psidium guajava</i> ^b	31	Tree	Cultivated	Leaves	Leaves are crushed and mixed with cold, warm or hot water. The infusion (125 ml) is drunk twice a day, until diarrhoea subsides.	Roots, leaves (Hutchings et al., 1996; Lin et al., 2002; Gutiérrez et al., 2008; Van Wyk et al., 2009)
<i>Sarcostemma viminalis</i> subsp. <i>viminalis</i> ^a	1	Succulent climber	Wild	Stem	Stem is crushed and mixed with cold water. The infusion (125 ml) is drunk twice a day, until diarrhoea subsides.	None found
<i>Schotia brachypetala</i> ^a	1	Tree	Wild	Bark	Bark is crushed and boiled in water. The infusion (125 ml) is drunk twice a day, until diarrhoea subsides.	Stem bark (Mathabe et al., 2006), bark and root (Van Wyk et al., 2009)
<i>Sclerocarya birrea</i> subsp. <i>caffra</i> ^a	20	Tree	Wild	Bark	Bark is crushed and mixed with hot, warm or cold water. The infusion is administered anally or orally. The infusion (125 ml) is drunk three times a day, until diarrhoea subsides. If administered anally the dosage depends on the person's weight.	Bark (Watt and Breyer-Brandwijk, 1962; Mathabe et al., 2006; De Wet et al., 2008)
<i>Senna occidentalis</i> ^b	3	Tree	Wild	Root	Roots are crushed and mixed with cold water. The infusion (60 ml) is drunk twice a day, until diarrhoea subsides.	Leaves (DeFilipps, 2004), roots (Kisnagau et al., 2007)
<i>Strychnos madagascariensis</i> ^a	14	Tree	Wild	Root, bark and leaves	Root, bark and leaves are crushed and mixed with cold water. The infusion (60 ml) is drunk twice a day, until diarrhoea subsides.	Bark, leaves (De Wet et al., 2008)
<i>Syzygium cordatum</i> ^a	7	Tree	Wild	Bark	Bark is crushed and mixed with water and boiled. The infusion (60 ml) is drunk three times a day, until diarrhoea subsides.	Bark, leaves (Hutchings, 1989; Van Wyk et al., 2009), stem bark (Mathabe et al., 2006)
<i>Terminalia sericea</i> ^a	3	Tree	Wild	Root or bark	Roots or bark are crushed and mixed with boiling water or cold water. The infusion is administered anally or orally. The infusion (60 ml) is drunk twice a day, until diarrhoea subsides. If administered anally the dosage depends on the person's weight.	Root (Watt and Breyer-Brandwijk, 1962; Hutchings et al., 1996), stem bark (Van Wyk et al., 2009)
<i>Trichilia emetica</i> ^a	4	Tree	Wild	Bark	Bark is crushed and mixed with either hot or cold water. The infusion is administered anally twice a day.	Bark (Githens, 1949)
<i>Vangueria infausta</i> subsp. <i>infausta</i> ^a	2	Shrub	Wild	Root or bark	Root or bark is crushed and mixed with cold or hot water. The infusion (250 ml) is drunk three times a day, until diarrhoea subsides.	Root (Gelfand et al., 1985), bark (De Wet et al., 2008)
<i>Vernonia natalensis</i> ^a	2	Herb	Wild	Root	Roots are crushed and boiled with water. The infusion (60 ml) is drunk twice a day, until diarrhoea subsides.	Whole plant (De Wet et al., 2008)

^a Indigenous to South Africa.

^b Naturalised exotics in South Africa.

Breyer-Brandwijk, 1962; Pooley, 1993, 1998; De Wet and Van Wyk, 2008).

The three most regularly used plant species in the study area are exotics, namely *Psidium guajava*, *Catharanthus roseus* and *Melia azedarach*, followed by the indigenous spp. *Sclerocarya birrea* and *Strychnos madagascariensis*. The plant parts mostly used are the

bark or leaves of the trees. The whole plant is used if a herb is administered. Roots are seldom used. The preparation method is mostly an infusion with cold or hot water and taken orally. When used as an enema, the dosage depends on the person's age and weight. Seven plants are used in five different combinations for enhanced antidiarrhoeal efficacy. These include the combination of

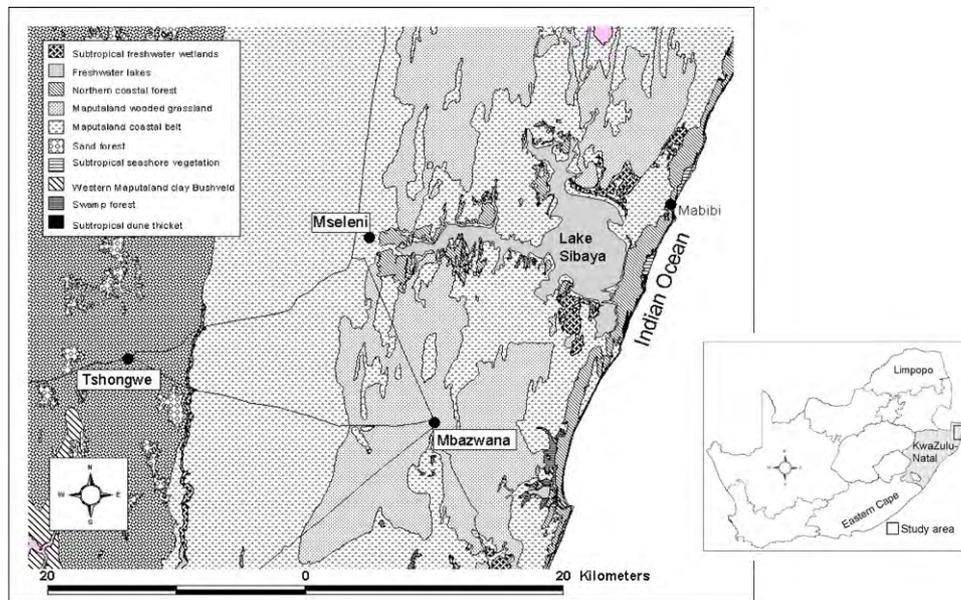


Fig. 1. Study area—northern Maputaland located in KwaZulu-Natal province, South Africa.

Brachylaena transvaalensis with *Psidium guajava*/*Sclerocarya birrea*, *Acanthospermum glabratum* in combination with *Krauseola mosambicina*/*Psidium guajava* or *Mangifera indica* in combination with *Sarcophyte sanguine*.

Eighty percent of the people interviewed were women, with an average age of 53 years. The interviewees had a basic education (grade 4) or no education at all. The interviewees obtained their medicinal plant knowledge from their grandmothers (33%), elders (20%), mothers (19%), neighbours (10%), fathers (9%) and grandfathers (9%). Despite the accessibility to 13 clinics and two hospitals in this Municipality district, all the interviewees prefer the use of medicinal plants above western medicine. The reasons given varied from cultural aspects, availability, belief that no side effects were evident and that medicinal plants were more effective than western medicine. Five of the interviewees had deceased a year after the first interviews were conducted (February 2008/2009). The remaining family members have limited or no knowledge on the use of medicinal plants. None of the plants being used are on the endangered list and the sustainable use of the plants is well practiced in the homesteads.

4. Discussion

Ethnobotanical surveys on antidiarrhoeal plants have been conducted in other parts of the world (Njoroge and Kibunga, 2007; Tetali et al., 2009). In a cosmopolitan urban area in Kenya, 97.45% of the local people use herbal preparations (41 plant species) to treat diarrhoea. Tetali et al. (2009) recorded 28 plant species which are traditionally used by a rural population in the Parinche valley in India to treat diarrhoea.

Data has recently been published on the ethnobotanical use of antidiarrhoeal plants in two provinces in South Africa, namely the Limpopo Province and KwaZulu-Natal Province (Lin et al., 2002; Mathabe et al., 2006; Appidi et al., 2008; Fawole et al., 2009). In three of the publications the information on the plants being used to treat diarrhoea came from traditional healers and sourced literature. The fourth publication (Appidi et al., 2008) used the same principle that was used in this study, where the residents of the homesteads were interviewed. Appidi et al. (2008) collected information from herbalists and rural dwellers in the Eastern

Cape. Seventeen plant species were identified as antidiarrhoeal treatments, none of which correspond with the 23 plant species collected in this study. The main reason could be the difference in the vegetation types between the two study areas. Another possible reason could be that the two study areas are inhabited by different ethnic groups, the Xhosa's in the Eastern Cape and the Zulu's in Maputaland.

Psidium guajava is the only plant species which is used by both, the Zulu traditional healers (Lin et al., 2002) and the rural people in our survey. *Psidium guajava* is one of the most recorded plant species used to treat diarrhoea in developed countries (Gutiérrez et al., 2008). In a more recent study on plants used for gastrointestinal disorders (Fawole's et al., 2009), information was obtained mostly from Hutchings et al. (1996). Only the documentation of *Vernonia natalensis* as a plant to treat diarrhoea corresponds with our findings (Table 2).

Mathabe's et al. (2006) survey on antidiarrhoeal plants was conducted with traditional healers (North Sotho ethnic group) in the Limpopo Province. Twenty-one plant species were mentioned to treat diarrhoea, of which four (*Gymnosporia senegalensis*, *Schotia brachypetala*, *Sclerocarya birrea* and *Syzygium cordatum*) correspond with our study. The traditional healers preferred the use of roots and bark (Mathabe et al., 2006), whereas in our survey the people used mostly the leaves (Table 2), which are more sustainable. The wide variety of plant species used for the treatment of diarrhoea in this study can possibly be explained by the rich plant biodiversity. The study area which falls in KwaZulu-Natal Province is known for its high plant diversity having over 6000 vascular plant species and 1258 genera (70% of the genera in southern Africa) (Scott-Shaw, 1999).

Only Mathabe et al. (2006) mentioned that one of the healers used three of the plant species in two different combinations to treat diarrhoea. These combinations are *Indigofera daleoides* with *Gymnosporia senegalensis* and *Indigofera daleoides* with *Waltheria indica*. It is surprising that so little information on plant combinations have been documented in ethnobotanical antidiarrhoeal studies when it is known that it is common practice in traditional healing to combine plants for increased efficacy. Our survey revealed that seven plant species are being used in five different combinations for better efficacy against diarrhoea.

5. Conclusion

Of the 23 plant species used by a rural community in northern KwaZulu-Natal to treat diarrhoea, *Acacia burkei*, *Brachylaena transvaalensis*, *Cissampelos hirta* and *Sarcostemma viminalis* are documented for the first time. Also recorded for the first time is the use of seven plant species in different combinations to enhance anti-diarrhoeal efficacy.

The results of the present study strengthens the evidence of Dahlberg and Trygger (2009), that medicinal plants play an important role in the primary health care system of the rural people in northern Maputaland, KwaZulu-Natal. The care-givers in the rural homesteads generally treat the same ailment by using a diverse range of plants which is primarily dependent upon plant availability in their area. The concept of treatment is based on the principle that the wider the choice of plant, the better the chance of a cure (Howard, 2003). The recognition and restoration of indigenous knowledge on traditional remedies and medicinal plants would enhance sustainable use of natural resources. Further studies are underway to establish the antibacterial efficacies of these plant species, and their combinations where applicable, against diarrhoea-causing micro-organisms.

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