Indigenous plants for ethnoveterinary uses in the Pondoland, South Africa

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Abstract

Over the years, indigenous practices have been used by natives as a means of controlling livestock diseases. Livestock producers have invaluable knowledge of medicinal plants and combine ethno-veterinary practices to reduce reliance on acaricides. The purpose of this study was to investigate and document the indigenous plants used for the treatment of livestock diseases. From the gathered data two plants were further studied for their antibacterial potential. The purpose was to test their medicinal value and their activity against 10 bacterial strains that cause an array of diseases. The results of this study revealed 23 plant species, belonging to 18 families that-are used for the treatment of livestock diseases. The results indicate that the leaves and roots were the most used plant parts. This study showed that the most common method of herbal preparation was infusion. Our observations showed that the rural natives of Pondoland still employ medicinal plants for ailing livestock, highlighting the need to preserve the indigenous knowledge of medicinal plants. Aqueous extracts of *Harpephyllum caffrum* inhibited both Gram-negative and Gram-positive bacterial strains at an MIC ranging from 0.5 to 1 mg mL^{-1}. The MIC for *Coddia rudis* was recorded at 5 mg mL^{-1} for all bacterial strains. This activity may explain and justify usage of *H. caffrum* and *C. rudis* among others for the treatment of livestock diseases in the study area.

Keywords: antibacterial, indigenous, livestock, medicinal plants

INTRODUCTION

The utilization of plants for the treatment of infectious diseases dates from the times of hunter-gatherers (Masika et al., 2000). This indigenous knowledge, passed from one generation to the next, has been useful in the treatment of ailing animals in the isiMpondo speaking communities of the study area. Livestock are susceptible to a variety of diseases, particularly in the wet season that limits productivity and affects their wellbeing (Brown, 2005). The herdsman is the one person who is often familiar with traditional herbal medicines for the treatment of ailing livestock (Beinart, 2007; Stroebel, 2004). Recent research has shown an increased interest in the local means of livestock management and treatment (Martin et al., 2001) as animal sickness is a major constraint to increased productivity. While villagers in Pondoland are faced with many constraints that limit the productivity of their livestock, communities are becoming aware that the use of traditional medicines from indigenous plants can improve the health of their sick livestock (Mokwala, 2007). The major constrains faced by the indigenous peoples in the Pondoland region is the prevalence of parasites and diseases, particularly during the wet season (Masika et al., 2000). High mortalities are reported due to the parasites and the diseases associated with ticks and tick borne diseases (Muchenje et al., 2008), such as anaplasmosis, babesiosis and ehrlichiosis, all of which cause morbidity and mortality of animals.

Livestock diseases are frequently restricted using conventional acaricides that have been considered as the best method for the treatment for ailing animals, however, the usage of acaricides has certain shortcomings. Conventional acaricides are expensive or unaffordable to rural farmers. Due to shortcomings of the conventional acaricides, rural farmers are resorting to alternative methods and remedies that fall within ethno-veterinary medicine. Ethno-veterinary medicine is community based local or indigenous knowledge

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and methods of caring for healing and managing livestock. Ethno-veterinary medicine consists of local people's knowledge dealing with folk beliefs, skills, methods and practices pertaining to animal healthcare and production (Martin et al., 2001). This could play an important role in grassroots development which seeks to empower people by enhancing the use of their own knowledge and resources (Bizimana, 1997).

Pondoland is one of the poorest regions in the Eastern Cape with high rates of unemployment. In the study area, livestock farming is held in high regard and conventional medicines are commonly used to control diseases. These conventional medicines, however, are generally very expensive and not easily accessible nor affordable to resource-limited rural farmers. Thus, farmers have begun to use of ethno-veterinary remedies to control livestock diseases that reduce animal productivity.

The purpose of this current study was to investigate and document the indigenous plants used for the treatment of livestock diseases in the Pondoland area of the Eastern Cape in South Africa.

MATERIALS AND METHODS

Ethnobotanical information

The study was initiated by first arranging meetings with the community leaders in the form of a chief or ward councilor in order to explain the purpose and importance of the research to the community-based development program as well as the researcher, seek permission to communicate and interview local inhabitants as well as seek cooperation from the locals.

The ethnobotanical information was gathered in various villages of the East Pondoland. Data were collected within a period of three months during 2011, using a field survey to gather, information on the uses of plants to treat animal diseases.

The collected data included local names of the plants, plant parts used, method of preparation, and the effectiveness of the medicine. As highlighted by Ribeiro et al. (2010), getting the required information directly from the herbalists was difficult, if not impossible, due to strong beliefs associated with the plant materials. Some herbalists, however, were willing to assist where possible and also some of the information was gathered from the villagers who were knowledgeable about medicinal plants.

Data were collected in a similar pattern as that used by Erasto et al. (2005), where some of the plants were growing within the area of the healers, herbalists, or local participants, while other plants were gathered through walks into the forests accompanied by traditional healers, herbalists, or rural dwellers. The plants were identified by their vernacular names, and later validated at the Kei Herbarium of Walter Sisulu University. Voucher specimens were prepared and deposited in the herbarium.

From the gathered ethnobotanical data, two plant species were identified for further studies of antibacterial activity. The purpose was to test their medicinal value and their activity against 10 bacterial strains that cause an array of diseases.

The plants *H. caffrum* and *C. rudis* were chosen based on reports of their efficacy, accessibility, and availability at the time of sampling, although among the least cited plants in the study. These plants were tested for antibacterial properties to ascertain their efficacy of herbal medicines for the treatment of livestock.

Plant preparation, extraction and methods

Plant tissue from both *H. caffrum* and *C. rudis* were extracted. The bark of *H. caffrum* and the leaves of *C. rudis* were separately air dried in the shade at room temperature. Then the two plant materials were ground into fine powders using a laboratory pestle and mortar. A total of 50 g of *C. rudis* leaves were placed in a flask with 1 L of water and then shaken in using a mechanical shaker for 24 h for extraction of constituents. For extraction of *H. caffrum* bark, 500 g was placed in a beaker with 3 L of water for extraction. The extracts were filtered using a Buchner funnel and Whatman No.1 filter paper (Kambizi and Afolayan, 2001). Each filtrate was concentrated to dryness under reduced pressure at 40°C in a rotary evaporator.

The dried plant extracts were re-dissolved in distilled water to prepare the required concentrations for stock solutions.

Preparation of agar-extract plates

Nutrient agar was prepared by pouring 1.68 g of agar into 60 mL of distilled water, mixed well, and heated for 90 s. Subsequently, 5 mL of the agar medium was dispensed into each of the 12 test tubes, autoclaved, and then allowed to cool a bit before the addition of the extracts. Different pipettes were used to pipette the extract into the test tubes. Agar medium was also poured into 12 petri dishes and were gently swirled to spread the agar evenly in the petri dish (Abu-Shanab et al., 2004; Aboaba et al., 2006). Of the 12 petri dishes, nine contained plant extracts and three had no extracts and used as controls. The petri dishes with agar media were left to cool overnight and for the solvent to dissipate.

Preparation of broth medium

Ten conical flasks were used for the preparation of nutrient broth. The broth was prepared by mixing 6.5 g with 500 mL of distilled water until dissolved. The broth medium was subsequently poured into ten conical flasks, closed with a cotton plug, and aluminum foil. The flasks with nutrient broth were then autoclaved for 15 min. The bacteria were streaked on the agar plate and left for 24 h.

Bacterial assay

The bacterial species used for testing were five Gram-positive (*Staphylococcus aureus*, *Staphylococcus epidermis*, *Bacillus cereus*, *Micrococcus kristinae*, *Streptococcus faecalis*) and five Gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa*, *Shigella flexneri*, *Klebsiella pneumonia*, *Serratia marcescens*). All the bacteria were obtained from the National Health Laboratory Service, Mthatha Academic Hospital (Jaca and Kambizi, 2011).

The bacteria were preserved by growing on nutrient broth in petri dishes for 24 h. Each agar medium-containing petri dish was divided into ten sections by drawing lines on the back of the petri dishes. The sections were numbered from 1 to 10 with each number representing a particular bacterium. The bacteria were streaked in radial patterns on the agar plates in the same manner as used by Jaca and Kambizi (2011, as cited in Kambizi and Afolayan, 2001). The cultures were subsequently sealed and incubated for 24 h at 37°C. The cultures were then visually inspected for bacterial growth.

RESULTS AND DISCUSSION

During the survey, some plant medicine samples were utilized by combining two or more plant species for the preparation of an effective treatment, but other plants were utilized as a single plant species.

Most plant species (52%) used for treatment of ailing livestock were herbs. Herbs were followed by trees, accounting for 26%, and these were closely followed by shrubs (22%). The current study revealed that herbs were used more often than both shrubs and trees combined.

In the use of medicinal plants, certain plant parts were used for the preparation of the medicines. In some instances, the whole plant species may be used to make a remedy. This study also revealed that leaves and roots are the two most utilized plant parts and combined, they account for about 52% of the herbal medicine used in treatment of livestock.

The minimum inhibitory concentration values of aqueous extracts of *H. caffrum* and *C. rudis* were determined (Table 1). While the exact concentrations of the extracts were not determined, the amounts used were 1.0, 5.0 and 10.0 mL. The extract of *H. caffrum* inhibited the growth of the entire Gram-negative bacteria with MIC of 1.0 in all Gram-negative bacteria with the exception of *Shigella flexneri*, which had an MIC of 10.0 mL of the extract, while most bacteria were killed at a minimum treatment level of 1.0 mL. Growth of most Gram-positive bacteria treated with *H. caffrum* had inhibited growth with the exception of *Micrococcus kristinae* which was not active at all.

Table 1. Medicinal plants used in East Pondoland.

Botanical name	Plant part used	Disease
Bulbine latifolia	Root	Skin problems
Pentanisia pruneloides	Root	Skin problems, gall sickness
Hypoxis rigidula	Corms	Black water
Stangeria eriopus	Root	Loss of condition, heart water
Albuca aurea	Bulb	Worms, loss of condition
Acacia elephantorrhiza	Bulb	Heart water
Cyphostemma cirrhosum	Stem	Urinary problems
Coddia rudis	Leaf	Skin problems (eliminates ticks)
Gunnera perpensa	Rhizome	Gall sickness, urinary infections
Alepidea amatymbica	Bulb	Skin problems, heart water
Burchellia bubalina	Leaf	Heart water
Cyphia stramonium	Leaf	Shivering endlessly
Clivia sp.	Root	Stomach problems
Schotia latifolia	Root	Skin problems
Asparagus africanus	Bulb	Heart water
Cissampelos capensis	Root	Skin problems, wounds
Ficus sp.	Bark	Wounds
Harpephyllum caffrum	Bark	Skin problems
Euphoorbia sp.	Leaf	Skin problems
Cussonia spicata	Bark	Heart water
Erythrina caffra	Bark	Heart water
Clerodendrum glabrum	Leaf	Worms

C. rudis extract inhibited growth in some bacteria, but was not active against other bacteria for either Gram-positive or Gram-negative. Notable bacteria that were not active are Gram-positive (*Bacillus cereus* and *Micrococcus kristinae*) and Gram-negative (*Pseudomonas aeruginosa* and *Shigella flexneri*). Minimum inhibitory level of acetone extract of *C. rudis* was 1.0 mL for active bacteria (Table 2).

Table 2. Antibacterial activity of aqueous extracts of *H. caffrum* and *C. rudis*.

Bacterial species	gram +/-	MIC (mg mL^{-1})	
		H. caffrum	*C. rudis*
Staphylococcus epidermis	+	1.0	1.0
Bacillus cereus	+	10.0	1.0
Micrococcus kristinae	+	n/a	n/a
Streptococcus faecalis	+	1.0	1.0
Escherichia coli	-	1.0	1.0
Pseudomonas aeruginosa	-	1.0	n/a
Shigella flexneri	-	10.0	5.0
Klebsiella pneumonia	-	1.0	1.0
Serratia marcescens	-	1.0	0.5

n/a: not active.

The study also revealed that the most common method of herbal preparation was infusion. This is by means of boiling pulverized plant material or mixing cold water with plant material and then administering the medicine within 24 h. Some plants have more than one vernacular name because the same plant is prepared in different ways in different communities to treat different ailments.

During the survey, the majority of the questioned participants frequently used medicinal plants to treat various ailments for both livestock and human wellbeing. This led

to a consensus that indeed plants are very important as sources of medicine and this could be because plants are the only natural resource at their disposal to combat livestock diseases.

CONCLUSION

Livestock diseases critically and adversely affect the wellbeing of animals as well as people. During this study, most of the people employed conventional medicine for the treatment of livestock illnesses, but some indigenous inhabitants from Pondoland still employ herbal treatments. Unfortunately, the indigenous knowledge of medicinal plants, which were effective against bacteria, is being abandoned by native people. To preserve the traditional knowledge, studies on the bioactivity of the plants and plant extracts need to be studied and the plants must be protected and preserved.

The two plants most investigated for antibacterial properties revealed enormous antibacterial potential. Our study showed the relevance and importance of potential medicinal plants in the treatment of contagious diseases affecting livestock. The observed antibacterial activity demonstrated that plants recommended by participants have high antibacterial potential and therefore may be used for the treatment of livestock illnesses as a primary health care delivery system for their livestock.

In essence, this study is important to the community of Pondoland at large for the preservation and documentation of the indigenous knowledge on medicinal plant usage. Future work involves in vitro antimicrobial assays as well as toxicity studies.

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