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Full Length Research Paper

The “Doctrine of Signatures” in herbal prescriptions in Ikale and Ilaje communities of Ondo State, Southwestern Nigeria

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The knowledge and application of the notion of “doctrine of signatures or correspondences” was evaluated among the Ikale and Ilaje people of Ondo State, Southwestern Nigeria. Information was solicited by administering questionnaires to one hundred and five (105) informants. Periodic field observations were also made. The research yielded 60 plants belonging to 37 families. The plants have characteristics such as colour, taste, habit, structure, and appellation which are suggestive of their trado-medical uses. *Azadirachtha indica*, *Petivera alliaceae*, *Vernonia amygdalina*, and *Morinda lucida* commonly known as “bitters” are used as antimalarial plants. Due to the shape of their fruits/tubers, *Kigelia africana* and *Ipomoea batatas* formed part of recipes used in the treatment of breast disorders while others such as *Carica papaya* and *Alstonia boonei* are useful as botanical galactogogues. Plants used for magical preparations are also documented. This study confirms the application of the doctrine in plant knowledge and uses. This doctrine can be applied in future bio-prospect and drug development.

Key words: Traditional medicine, Doctrine of Signatures, ethnobotany, Ondo State, Nigeria.

INTRODUCTION

The “doctrine of signatures or correspondences” developed in Europe in the 16th and 17th centuries, following the collation and consolidation of the body of material that comprised it, asserts that the way plants look, taste, react or are shaped offers strong clues to their medicinal applications (Lev, 2002). This ancient

pharmacological theory maintains that similarity between plant habitat or appellation and human features is suggestive of their trado-medical uses. It is believed that these characteristics, commonly called “signatures”, are God-given and have possible implications for classification of medicinal plants as well as uses and

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other properties (Saifullahi et al., 2017). Major categories of this doctrine are: 1.) similarity between the shape of the plant organ and the ailing human organ; 2.) similarity between animal shape or behavior to human organ; 3.) similarity of plant colour to the colour of the disease's symptoms; and 4.) similarity of plant characters to human features (Dafni and Lev, 2002). Earlier, Hocking (1977) submitted that the doctrine could be broken down into two chief components which are: 1.) nature has provided in every region plants for remedies which the diseases common to that region require for treatment; and 2.) nature has also provided signs or symbols to indicate by physical characteristics of the drug (colour, shape, taste etc.) the diseases/disorders for which the plant is a remedy.

The Southwestern region of Nigeria is inhabited by people who are particularly rich in customs and traditions. Hence, the Yoruba mythology explains the origin and belief of many cultural concepts in the daily life and practices of the Yorubas (Oso, 1977). This includes the use of plants for the prevention or cure of mild or chronic ailments. Few studies have been conducted in Israel, India, China, and USA (Dafni et al., 1984; Richardson-Boedler, 1999; Dafni and Lev, 2002; Lev, 2002; Bennett, 2007, Kumath, 2015); published information, however, on this concept in Nigeria is scarce and fragmentary.

The aim of this study, being part of a conjunctive focus on indigenous medicines and their furtherance, was to evaluate the knowledge and application of the "doctrine of signatures" among the Ikale and Ilaje people of Ondo State with a view to presenting the plants for biological screening. The doctrine could serve as a reliable basis for future bio-prospect and drug development.

METHODS

Region and study area

The study was conducted in Ondo State, Southwestern region of Nigeria. Twelve (12) localities in Ikale and Ilaje communities were visited periodically. These areas are occupied majorly by the Ikale and Ilaje-speaking people, other Yorubas (Oyo, Osun, and Ekiti) and Igbira (Edo). The primary economic activity is agriculture. The principal crops are oil palm, plantain and cassava (processed into different food products). Other human activities include fish and vegetable business. Civil servants also inhabit the areas.

Administration of questionnaires

Information about plants was elicited from residents in the areas with the aid of structured questionnaires and personal interview. The purpose of the study was explained to the respondents and informed consent was sought. Only information from willing informants was documented. The questionnaire was divided into two sections. Section 1 was on the demographic variables of respondents while section 2 evaluated informants' knowledge on the characteristics of plants vis-à-vis their supposed uses.

Respondents were cross-questioned to confirm the authenticity of information given. Interview was conducted in the local language (Yoruba, and where necessary the service of an Ikale/Ilaje speaking person was employed). Responses were filled into the questionnaires after each fielded question. The identities of the plants were confirmed using live specimens and reference text (Gbile, 2002); OSUSTECH Herbarium was also consulted. Voucher specimens were deposited in the same herbarium.

RESULTS AND DISCUSSION

Twelve (12) localities were visited. The number of respondents interviewed in the localities was not even because only complete data from willing informants in each locality were documented. The demographic variables of respondents are presented in Table 1. Out of the 105 informants interviewed, 73.33% were males while 26.67% were females. The age of the informants ranged from 30 to 70 years; 56.19% of the informants were between 50 and 60 years. Twenty-seven (27) of the 105 respondents were illiterate, 59 had first school leaving certificate (FSLC), 12 possessed Senior School Certificate (SSC), 5 obtained Ordinary National Diploma (OND) or National Certificate in Education (NCE) while the remaining 2 held higher national diploma (HND) or a first degree (B.Sc./B.A.). Only one (1) respondent, by marital status, was single. Others were married (99.29%), divorced (2.86%) or widowed (1.90%). A large percentage (68.57%) of the respondents practiced Christianity, 14.29% practiced Islam while 17.14% practiced African traditional religion. Ninety-seven (97) of the informants are native of the study area; eight (8) respondents informed that they migrated to the area and had been residing for 10-15 years in the communities. Clearly, majority of the informants had been residing in the study area for more than 15 years. The respondents were herb sellers (25.71%), herbalist (34.29%), farmers (20%), artisan (5.71%), traders (1.90%), birth attendants (2.86%), and civil servant (9.52%).

Table 2 shows the profile of the plants used for medicinal purposes based on the "doctrine of signatures". Sixty (60) plants belonging to 37 families having characteristics that relate to the medicinal uses are documented. The characteristics/signatures mentioned are shape/structure of fruit/pod and leaf, colour of stem bark and root, colour of latex from leaf/leaf extract, seed set, taste of leaf extract, texture of stem bark, and local/vernacular names of the plants. The medicinal applications vary and include anti-malaria, blood tonic/booster, personal protection, favour of the elders, maternal issues, and ease of delivery etc. In majority of traditional cultures or illiterate societies or educationally less-privileged communities, this "law of similitude" serves a symbolic purpose and helps to transfer medicinal information from generation to generation; it also serves as a mnemonic aid for apprentice learning by

Table 1. Demographic variables of respondents on the "Doctrine of Signatures in Herbal Prescriptions" in Ikale and Ilaje Communities of Ondo State, Southwestern Nigeria

Parameter	Specification	Frequency (%)
Community	Ayeka	13 (12.38)
	Erinje	12 (11.43)
	Idepe	9 (8.57)
	Igbodigo	8 (7.62)
	Igbokoda	10 (9.52)
	Igbotako	8 (7.62)
	Igodan	3 (2.86)
	Ikoya	2 (1.90)
	Ilutuntun	7 (6.67)
	Irele	10 (9.52)
	Ode-Aye	9 (8.57)
Okitipupa	14 (13.33)	
Gender	Male	77 (73.33)
	Female	28 (26.67)
Age (years)	>30≤40	3 (2.86)
	>40≤50	18 (17.14)
	>50≤60	59 (56.19)
	>60≤70	25 (24.81)
Level of Education	Unlettered	27 (25.71)
	FSLC	59 (56.19)
	SSCE	12 (11.43)
	OND/NCE	5 (4.76)
	HND/First Degree	2 (1.90)
Marital Status	Single	1 (0.95)
	Married	99 (94.29)
	Widow	2 (1.90)
	Divorced	3 (2.86)
Religion	Christianity	72 (68.57)
	Islam	15 (14.29)
	Traditional	18 (17.14)
Nativity	Yes	97 (92.38)
	No	8 (7.62)
Length of Residency (years)	>10≤15 yrs	8 (7.62)
	>15≤20 yrs	35 (33.33)
	>20 yrs	62 (59.05)
Profession	Herb seller	27 (25.71)
	Herbalist	36 (34.29)
	Farmer	21 (20.00)
	Artisan	6 (5.71)
	Trader	2 (1.90)
	Birth Attendant	3 (2.86)
	Civil Servant	10 (9.52)

N = 105.

observation (Bennett, 2007).

It is believed, traditionally in Nigeria, that food and drinks which are sweet or sugary are not good for the

body as they increase the sugar content of the body, and if not checked could probably result in pile or hemorrhoid. This lends some credence to the use of plants like

Azadirachtha indica, *Petivera alliaceae*, *Vernonia amygdalina*, and *Morinda lucida* as anti-malarial plants. These plants are generally called “bitters” and are common trade medicines hawked by herb vendors in Nigeria. Others such as *Kigelia africana* and *Ipomoea batatas* formed part of recipes used in the treatment of breast disorders. Majority of the human populations in the world have employed this concept of signatures to prevent or cure diseases, or to bring physic to a particular body organ (Lev, 2002).

The colour of extracts from leaves/stem bark/root/rhizomes or latex/juices of some plant parts confers the “signature” and suggests their medicinal applications. In this category are: decoction of *Sorghum bicolor* (blood supplement), and latex of *Euphorbia laterifolia* (to manage ear ache). This finding is in agreement with Richardson-Boedler (1999) who reported the significance of colour and form of the leaves of *Hepatica triloba* (liverwort) to its healing powers on human liver. Also, Dafni et al. (1984) noted that the doctrine reflected in the use of the yellow decoction obtained from leaves of *Rhamnus alaternus* and the yellowish juices from fruits of *Ecbalium elaterium* for jaundice. Oil from roasted leaf of *Bryophyllum pinnatum* is used to alleviate ear ache while seeds of *Garcinia kola* are stimulants for the hepatic duct.

The local names (Yoruba: Nigeria) of some plants e.g. *Ato*, capable of mending (*Chasmanthera dependens* to remedy bone fractures), *jokoje*, sit down quietly (*Cissampelos owariensis* to manipulate people and make them apathetic), *ewe aje*, lucrativeness (*Myrianthus arboreus* to attract customers and boost business), *abiwere*, deliver with ease (*Hybanthus enneaspermus* for easy delivery) fit the “doctrine of signature” and influence to a large extent the application of these plants. Others are: *Petiveria alliaceae* – *awogba* (awo, cure; igba, 200) (to cure ca. 200 ailments), *Anthocleista vogelli* – *anikanwogbarun* (anikan, alone; wo, cure; igba, 200; arun, disease) (exclusively capable of curing ca. 200 diseases). Kumath (2015) informed that plants with prominently jointed stems help cure bone fractures or dislocations.

The texture and/or appearance of some plant parts (leaf surface and stem bark indentation) complied with the signature concept. For example, *Trema orientalis* and *Dalbergia lactea* are used in the management of measles and skin diseases respectively. The fruit shape of *K. africana*, the stem latex of *Alstonia boonei*, and the fruit and stem latex of *Carica papaya* make the plants important botanical galactogogues; these plants are also used to treat ailments relating to the mammary glands. Kumath (2015) informed that yellow flowers, latex, and dyes are used to treat jaundice while plants that have white latex are used as galactogogues.

Plants such as *Cissampelos owariensis* (*jokoje*, sit down quietly) and *Uvaria picta* (*alupayida*, sleight-of-hand) feature in magical traditions. These plants are used

to work on people’s emotions and make them apathetic, and to impress invisibility respectively. The compact arrangement of the seeds of *Aframomum melegueta* (atare) informs its use by pregnant women to prevent miscarriage. Richardson-Boedler (1999) described the correlation between plant characters and human symptoms. Hocking (1977) reported that the surface sculpture of nutmeg kernel (*Myristica fragrans*) has a similitude to the superficies of the brain; hence its use as a cerebral or neural medicinal agent.

Animals, minerals, and chemicals have also found a place in the “law of correspondence” (Richardson-Boedler, 1999). Pliny (Gaius Plinius Secundus, AD 23-79) correlated the lungs, liver, and stomach of lower animals with human organs and used these in treating the diseases of these organs in man (Hocking, 1977). Plant chemical investigations have shown that phytochemicals such as monoterpenes and bitter principles (in *V. amygdalina*, *Ocimum gratissimum* etc.) correlate with physical properties and healing potentials of the plants (Bennett, 2007). A similar study was conducted in Zimbabwe by Nyazema et al. (1994). Although the authors compared the efficacy of praziquantel and some medicinal plants based on the doctrine, it was established that the plants complied with the signature concept. The findings of the present study are in line with our previous reports (Erinoso and Aworinde, 2012; Aworinde and Erinoso, 2015).

The proponent of the “law of similes”, Paracelsus (Theophrastus Bombastus von Hohenheim, 1493-1591) and his followers have received heavy criticisms after the concept was introduced into the herbal lexicon, and as such the concept has been regarded as fanciful, far-fetched, pre-modern, pre-scientific, primitive, unreliable, and unscientific (Bennett, 2007; see Table 2 for recent assessments and sources). Nonetheless, association with a signature makes it easier to remember a plant and transmit knowledge about its use (Bennett et al., 2002). This association also has physical as well as psychological/spiritual undertones.

CONCLUSION AND APPLICATION OF FINDINGS

This study confirms the knowledge and application of the “doctrine of signatures” in plant uses among the Ikale and Ilaje people of Ondo State. In the “art of signs” or “law of correspondence”, plant characters such as colour of extracts/latex, taste of decoctions, shape of plant organs as well as the local name of plants serve as guides in the use of these plants for medical purposes. In other words, like colours, shapes, and characteristics in plants cure those same or corresponding colours, shapes, and other characteristics in the body part or disease in animals and humans. This research finds application in future plant exploration and the development of new drugs to combat

Table 2. Profile of plants used for different ailments based on the “Doctrine of Signatures” in Ikafe and Ilaje Communities of Ondo State, Southwestern Nigeria.

S/N	Local Name (Nigeria: Yoruba)	Botanical Name	Common Name	Family	Part Used	Signature	Medicinal Use
1.	Dongoyaro	<i>Azadirachtha indica</i> A. Juss	Neem tree	Meliaceae	Leaf, Bark	Taste	Malaria
2.	Awogba arun	<i>Petiveria alliacea</i> L.	Congo root	Phytolacaceae	Stem bark	Taste	Malaria
3.	Ewe tea	<i>Cymbopogon citratus</i> (DC.) Stapf	Lemon grass	Poaceae	Leaf	Taste	Malaria
4.	Ogbe akuko	<i>Heliotropicum indicum</i> L.	Cock's comb	Boraginaceae	Fruit	Shape	Mouth wash
5.	Aran	<i>Spigelia anthelmia</i> L.	Worm weed	Loganiaceae	Whole plant	Name	Memory enhancer
6.	Alupayida	<i>Uvaria picta</i> (Jacq.) Desv.	Dabra	Fabaceae	Leaf	Name	Magic/Voodoo
7.	Anikanwogbarun	<i>Anthocleista vogelli</i> Planch.	Cabbage tree	Gentianaceae	Leaf, Bark	Name	General remedy
8.	Ewuro	<i>Vernonia amygdalina</i> Delile	Bitter leaf	Asteraceae	Leaf	Taste	Malaria
9.	Afon	<i>Treculia africana</i> Decne.	Afr. breadfruit	Moraceae	Fruit	Shape	Miscarriage
10.	Jogbo	<i>Hyptis suaveolens</i> (L.) Poit	Bush tea	Lamiaceae	Whole plant	Taste	Malaria
11.	Eri-i-ljebu	<i>Vernonia colorata</i> (Wild.) Drake	Bitter tree	Asteraceae	Leaf, Root	Name	Poison antidote
12.	Oju ologbo	<i>Abrus precatorius</i> L.	Precatory-bean	Fabaceae	Leaf	Minty leaf tip	Cough/Expectorant
13.	Ose	<i>Adansonia digitata</i> L.	Baobab	Malvaceae	Fruit	Shape	Bladder disease
14.	Ato	<i>Chasmanthera dependens</i> Hochst.	Chasmanthera	Menispermaceae	Stem	Name	Bone fractures
15.	Ewe jokoje	<i>Cissampelos owariensis</i> P.Beauv. e)	Cissampelos	Menispermaceae	Leaf	Name	Magic/Voodoo
16.	Ewe aje	<i>Myrianthus arboreus</i> P. Beauv.	Cork wood	Urticaceae	Leaf	Name	Business booster
17.	Eegun eja	<i>Phyllanthus muellarianus</i> (Kuntze) E	Myrobalan	Phyllanthaceae	Stem, Leaf	Thorns	Skin diseases
18.	Abiwere	<i>Hybanthus enneaspermus</i> (L.) F. M	Spade flower	Violaceae	Whole plant	Name	Easy delivery
19.	Ijebo	<i>Entandrophragma utile</i> Dawe & Spra	Utile	Meliaceae	Bark, Root	Colour	Blood tonic
20.	Emi	<i>Vitellaria paradoxa</i> C.F. Gaertn.	Shea butter	Sapotaceae	Seed	Colour	Nasal congestion
21.	Gbogbonse	<i>Uvaria afzelii</i> Scott-Elliot	Cluster pear	Annonaceae	Root, Fruit	Name	General remedy
22.	Irosun	<i>Baphia nitida</i> Lodd.	Cam wood	Fabaceae	Leaf	Name	Tooth decay
23.	Ira-Odan	<i>Bridellia ferruginea</i> Benth	-	Phyllanthaceae	Stem	Name	Mouth wash
24.	Abeere-oloko	<i>Bidens bipinnata</i> L.	Marigold	Asteraceae	Fruit	Name	Easy delivery
25.	Owo	<i>Lophira alata</i> Banks ex C.F. Gaertn	Iron wood	Ochnaceae	Leaf	Name	Respect/Favour
26.	Sawerepepe	<i>Cyathula prostata</i> (L.) Blume	Pasture weed	Amaranthaceae	Whole plant	Name	Pain relief
27.	Odundun-owo	<i>Emilia coccinea</i> (Sims) G. Don.	Emilia	Asteraceae	Leaf	Name	Malaria/Jaundice
28.	Oro-wewe	<i>Euphorbia laterifolia</i> Schum & Thonn	-	Euphorbiaceae	Leaf, Root	Colour of late:	Ear infections
29.	Fuyafuya	<i>Lapartea aestuans</i> (L.) Chew.	Indian woodnettle	Urticaceae	Whole plant	Name	Stops bedwetting
30.	Ibo	<i>Landophia hirsuta</i> (Hua) Pichon	Ibo tree	Apocynaceae	Stem	Name	Erectile dysfunction
31.	Okikan	<i>Spondias mombin</i> L.	Yellow mombin	Anacardiaceae	Leaf	Name	Placenta evacuation
32.	Abere	<i>Parinari</i> sp. Aubl.	-	Chrysobalanaceae	Fruit	Name	General favour
33.	Isirigun	<i>Carica papaya</i> L.	Pawpaw	Caricaceae	Leaf, Latex	Colour	Lactation
34.	Patanmo	<i>Mimosa pudica</i> L.	Sensitive plant	Fabaceae	Whole plant	Name	To prevent wastefulness
35.	Akomu	<i>Pycnanthus angolensis</i> (Welw.) Warl	Wild nutmeg	Myristicaceae	Bark	Name	To prevent sore gum
36.	Ojiji	<i>Dalbergia lactea</i> Vatke	-	Fabaceae	Stem	Shape	Skin diseases
37.	Alawefon	<i>Sterculia tragacantha</i> Lindl	-	Malvaceae	Leaf	Sticky leaves	Dysentery/Pile
38.	Odundun	<i>Bryophyllum pinnatum</i> (Lam.) Oken	Resurrection plant	Crassulaceae	Leaf	Shape	Fever/Ear ache
39.	Sagere	<i>Strophanthus hispidus</i> DC.	Br. Strophanthus	Apocynaceae	Stem	Name	Rheumatism/Stroke
40.	Atare	<i>Aframomum melegueta</i> K. Schum	Alligator pepper	Zingiberaceae	Fruit	Seed set	Prevents miscarriage
41.	Apata	<i>Microdesmis puberula</i> Hook. F. Planch	Microdesmis	Pandaceae	Pod	Shape	General weakness
42.	Afefe	<i>Trema orientalis</i> (L.) Blume	Charcoal tree	Cannabaceae	Stem bark	Texture	Measles
43.	Pandoro	<i>Kigelia africana</i> (Lam.) Benth.	Sausage tree	Bignoniaceae	Fruit	Shape	Breast cancer
44.	Worowo	<i>Senecio biafrae</i> Oliv. & Hien	English spinach	Asteraceae	Leaf	Name	Blood tonic
45.	Oruwo	<i>Morinda lucida</i> Benth.	Indian mulberry	Rubiaceae	Leaf	Taste	Malaria
46.	Eekan ehoro	<i>Allophylus africanus</i> P. Beauv.	Afr. false currant	Sapindaceae	Leaf	Shape	Skin rashes
47.	Kankan ayaba	<i>Luffa cylindrica</i> M. Roem	Loofah	Cucurbitaceae	Fruit	Structure	Sponge

Table 2. Cont'd.

48.	Iseketu	<i>Sida acuta</i> Burm.f.	Wire weed	Malvaceae	Whole plan	Name	Treatment of ulcer
49.	Kukunduku	<i>Ipomoea batatas</i> (L.) Lam.	Sweet potato	Convolvulaceae	Tuber	Shape	Breast cancer
50.	Iyere	<i>Piper guineense</i> Schum. & Thonn.	Afr. black pepper	Piperaceae	Fruit	Taste	Treatment of hypertension
51.	Akerejupon	<i>Sphenocentrum jollyanum</i> Pierre	Sphenocentrum	Menispermaceae	Root	Colour	Pile
52.	Iru	<i>Parkia biglobosa</i> (Jacq.) R.Br.ex Dor	Afr. locust bean	Fabaceae	Seed	Shape	Visual modality
53.	Eyin olobe	<i>Phyllanthus amarus</i> Schum. & Thonn	Phyllanthus	Phyllanthaceae	Leaf	Shape	Kidney stones
54.	Emi-ile	<i>Euphorbia hirta</i> L.	Asthma herb	Euphorbiaceae	Whole plan	Latex	Poison anti-dote
55.	Ahun	<i>Alstonia boonei</i> De Wild.	Pattern wood	Apocynaceae	Stem latex	Colour	Galactogogue
56.	Awusa/Asala	<i>Plukenetia conophora</i> Mull. Arg.	Afr. walnut	Euphorbiaceae	Root	Taste	Snake bite anti-dote
57.	Agbayun	<i>Synsepalum dulcificum</i> (Sch. & Th.)	Miracle plant	Sapotaceae	Fruit	Shape	Weight loss
58.	Oka-baba	<i>Sorghum bicolor</i> (L.) Moench.	Sorghum	Poaceae	Stem, Leaf	Colour	Blood tonic
59.	Elemi	<i>Dacryodes edulis</i> H.J. Lam	Bush pear	Bursaceae	Fruit	Structure	Kidney stones
60.	Orogbo	<i>Garcinia kola</i> Heckel	Bitter kola	Clusiaceae	Seed	Shape	Hepatoprotective

Where names of plants are cited as signatures, the local names refer to the medicinal applications.

both ancient and new episodes of human diseases.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

- Aworinde DO, Erinoso SM (2015). Ethnobotanical investigation of indigenous plants used in the management of some infant illnesses in Ibadan, Southwestern Nigeria. *African Journal of Traditional, Complementary and Alternative Medicines*, 12(1):9-16.
- Bennett BC (2007). Doctrine of Signatures: An explanation of medicinal plant discovery or dissemination of knowledge. *Economic Botany*, 61(3):246-255.
- Bennett BC, Baker MA, Gomez P (2002). Ethnobotany of the Shuar of Eastern Ecuador. *Advances Economic Botany*, 14:1-299.
- Dafni A, Lev E (2002). The Doctrine of Signatures in Present-Day Israel. *Economic Botany*, 56(4):328-334.
- Dafni A, Yaniv Z, Palevitch D (1984). Ethnobotanical survey of medicinal plants in Northern Israel. *Journal of Ethnopharmacology*, 10(3):295-310.
- Erinoso SM, Aworinde DO (2012). Ethnobotanical survey of some medicinal plants used in traditional health care in Abeokuta areas of Ogun State, Nigeria. *African Journal of Pharmacy and Pharmacology*, 6(18):1352-1362.
- Gbile ZO (2002). Vernacular names of Nigerian plants (Yoruba), 2nd Edition, Forestry Research Institute of Nigeria, Ibadan. Molukom Press, Ibadan. 101p.
- Hocking GM (1977). The Doctrine of Signatures. *Quarterly Journal of Crude Drug Research*, 15(4):198-200.
- Kumath V (2015). "Doctrine of Signatures": An age old theory with special reference to some Ayurvedic medicinal plants. *Journal of Laboratory and Life Science*, 1(1):45-53. Available at: <http://www.jolsc.com/volume1-first-issue/V1-11-5-45-53.pdf>
- Lev E (2002). The doctrine of signatures in the medieval and Ottoman Levant. *Vesalius*, 8(1):13-22.
- Nyazema NZ, Njdamba J, Anderson C, Makaza N, Kaondera KC (1994). The Doctrine of Signatures or Similitude: A Comparison of the Efficacy of Praziquantel and Traditional Herbal Remedies Used for the Treatment of Urinary Schistosomiasis in Zimbabwe. *International Journal of Pharmacognosy*, 32(2):142-148.
- Oso BA (1977). Mushrooms in Yoruba mythology and medicinal practices. *Economic Botany*, 31(3):367-371.
- Richardson-Boedler C (1999). The Doctrine of Signatures: a historical, philosophical and scientific view (I). *British Homoeopathic Journal*, 88(4):172-177.
- Saifullahi U, Ahmed A, Abdulhamid Z (2017). Hausa plant systematics and doctrine of signature. Book of Abstracts, 25th Annual Conference of the Botanical Society of Nigeria (BOSON), Usman Danfodio University, Sokoto, Nigeria: 2nd - 6th July, 2017. Available at: <http://bosonudus.udusok.edu.ng/#menu3>

Full Length Research Paper

An ethno-veterinary survey of medicinal plants used to treat bacterial diseases of livestock in three geographical areas of the Eastern Cape Province, South Africa.

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An ethno-veterinary survey of plants used to treat certain bacterial diseases of livestock in three geographical areas of the Eastern Cape was conducted during 2013 to 2014. A purposive sampling technique was carried out using a semi-structured questionnaire and field observations to document indigenous knowledge in 48 communal households. From the respondents of the 48 households, 64.6% men and 35.4% women were interviewed regarding their knowledge on the use of plants for the treatment of bacterial diseases in livestock. Ten, eighteen and twenty respondents were surveyed at Goso, Ciko and Upper Ngqumeya, respectively. Six plants species, belonging to 6 families were documented and claimed by farmers to be used for the treatment of black quarter and paratyphoid in cattle. Results obtained showed that *Agapanthus praecox Willd.*, *Sarcophyte sanguinea* and *Olea europaea* subsp. *africana* were used to treat black quarter, while *Strychnos henningsii*, *Acokanthera oppositifolia* and *Dalbergia obovata* were used to treat “perceived” paratyphoid in calves. Bark and leaves were the commonly used plant parts. Decoction and infusion were the main methods of preparation, while oral administration was the common route for treatment. Determination of the dose was done by using certain size bottles and plant parts by the handful as measurements. In the light of the present data, it can be concluded that, medicinal plants play a role in healthcare of livestock in rural communities.

Key words: Cattle diseases, communal, farmers, Eastern Cape, medicinal plants.

INTRODUCTION

The Eastern Cape holds huge and diverse livestock wealth, estimated to be composed of 7, 085 million sheep, 5, 867 million goats and 3, 300 million cattle of which seventy percent is owned by small-scale resource

limited farmers (Livestock Statistics, 2015). Livestock are widely distributed in different agro-ecological zones where they are reared for products such as milk, meat, skin, mohair, hides and wool. They have great importance

as a source of income, draught power, fertilizer and cultural functions for small and landless farmers in rural areas (Githiga et al., 2005).

Farmers in communal production systems do not regularly apply recommended livestock management practices. The high prevalence of diseases in the communal sector poses serious problems for livestock development (Kiff et al., 1999). In different regions in Africa, livestock production is threatened with disease from various origins (Basheir et al., 2012). Diseases not only affect production but also affect import and exports of animal products. In order to get better returns on investment, animals under communal production systems need to be kept healthy and productive through the effective use of mobile veterinary services (Basheir et al., 2012).

In the past centuries, many ethno-veterinary medicines and their uses have been neglected due to the development of conventional drugs. However, as a result of the high cost of conventional medicines, unavailability and poor or lack of health care services in rural areas, traditional healers have made use of alternative methods of controlling livestock diseases (Harun-or-Rashid et al., 2010) and thereby complementing the commercial use of veterinary drugs (Shen et al., 2010). Use of ethno-veterinary medicine to control livestock diseases has been cited by the World Health Organization (2010), who estimated that 80% of people in developing countries depend on traditional medicine to treat livestock diseases. In the 19th century, medicinal plants have gained importance in the management of animal health care in African countries (Njoroge and Bussmann, 2006) and led to the discovery of some effective ethno-veterinary products (Lans et al., 2007). In developing countries, traditional medicines are considered to be cheap, safe and readily available to the resource limited farmers (Jabbar et al., 2005; Teklehaymanot and Giday, 2007).

Diseases caused by bacteria have been reported to cause high livestock morbidity and low production in many developing countries (Duguma et al., 2012). Research has been conducted, by various institutions, leading to the identification, utilization, and documentation of medicinal plants used in ethno-veterinary practices (Masika et al., 2000; Van der Merwe et al., 2001; Masika and Afolayan, 2003; Moyo and Masika, 2009; Dangwal et al., 2011; Luseba and Tshisikhawe, 2013; Mahwasane et al., 2013; Asimwe et al., 2014; Dragoeva et al., 2015). Considering the frequent cases of bacterial resistance to conventional drugs used around the world, farmers have

resorted to medicinal plants to treat livestock diseases especially bacterial diseases in South Africa and other parts of the world.

This study was conducted to document the indigenous knowledge of plants used in ethno-veterinary practices by resource-limited farmers, in certain parts of the Eastern Cape Province of South Africa. The purpose was to provide some baseline information, which could be used in the future development of drugs and make contribution to the conservation of this valuable knowledge and biological resources.

MATERIALS AND METHODS

Study area

The study was carried out in three Local Municipalities (LM) of the Eastern Cape Province (Figure 1), which is spread across three agro-ecological zones. It was conducted from November 2013 to February 2014. Letters seeking approval for assistance and co-operation from local offices of agriculture in mobilizing livestock farmers and community leaders, who have knowledge of medicinal plants, were submitted to the relevant authorities. The three areas surveyed were Upper Ngqumeya, Ciko and Goso.

Upper Ngqumeya is located 10 km south of the town of Keiskammahoek and falls under the administration of Amahlathi Local Municipality. It is located at 32°43'08.87"S longitude and 27°07'42.14"E latitude. The vegetation surrounding Upper Ngqumeya is a mixture of thicket, forests, savanna and grassland. Southern Mistbelt Forests occur as fragments within surrounding Buffels Thicket and Bisho Thornveld (Mucina and Rutherford, 2006). Amathole Mountain Grassland is restricted to higher mountain plateaus.

Ciko is located 7 km east of the town of Willowvale and falls under the administration of Mbhashe Local Municipality. It is located at 32°16'11.18"S Longitude and 28°32'03.22"E Latitude. Semi-deciduous woodland and thicket of the Eastern Valley Bushveld characterizes the vegetation of the Shixini River Valley. Whereas the southern slopes are wetter and cooler the steep northern slopes are typically hotter and drier. Along the upper slopes and plateau of the Shixini River, the vegetation is open thornveld associated with Bisho Thornveld. Scattered forest fragments of the Southern Mistbelt Forest occur in sheltered south-east facing valleys within the Eastern Valley Bushveld.

Goso is located 15 km south of the town of Lusikisiki and falls under the administration of Ingquza Hill Local Municipality. Goso is located at 31°22'49.38"S longitude and 29°35'48.57"E latitude. The vegetation is associated with the Indian Coastal Belt and patches of Scarp Forests. To the interior the vegetation becomes Ngongoni Veld. Goso occurs within a significant region of floristic endemism namely the Pondoland Centre (van Wyk and Smith, 2001).

Data collection

A semi-structured questionnaire, observations and guided field

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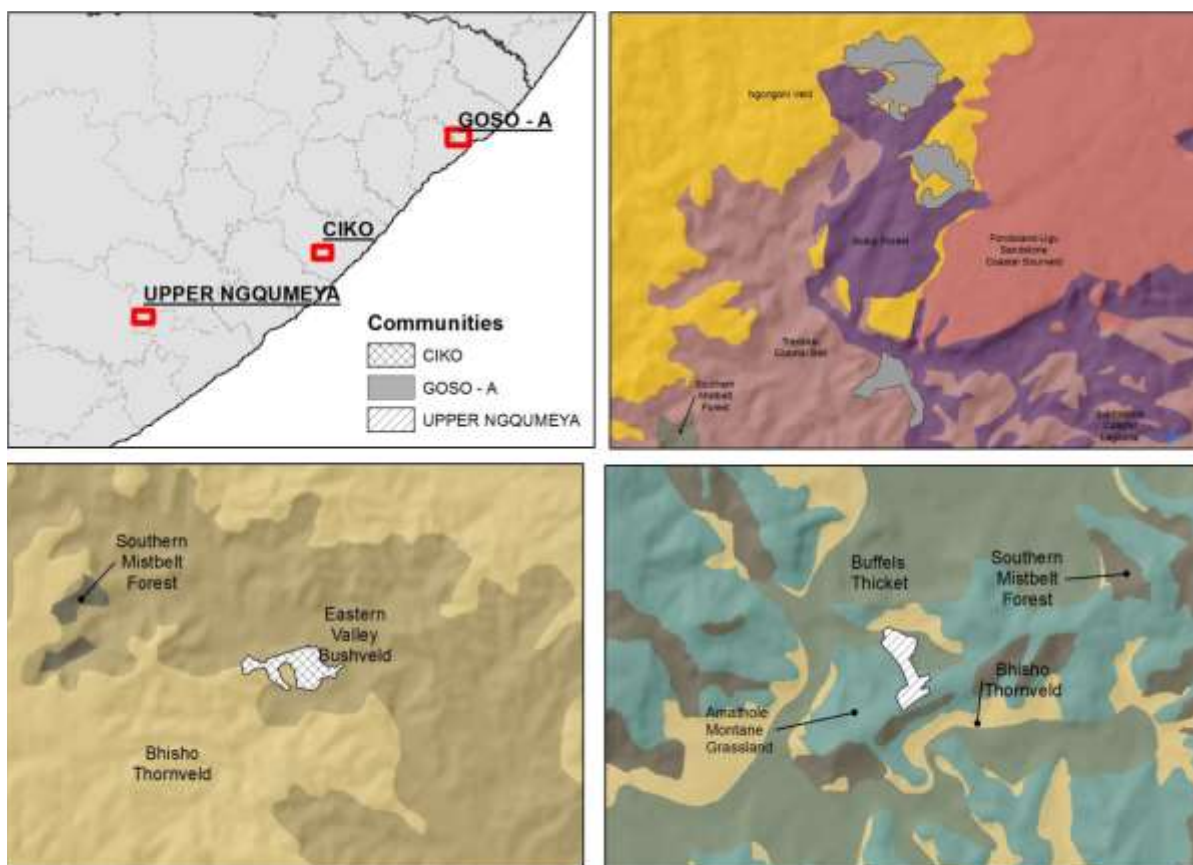


Figure 1. Selected local municipalities in the Eastern Cape Province.

walks with knowledgeable informants selected by elders were employed to obtain ethnobotanical data. A total of 48 respondents from 48 households (31 males and 17 females) were selected purposively with the assistance of extension officers, community elders and local authorities, based on their traditional knowledge of medicinal plants and willingness to participate. Each participant was separately interviewed in their vernacular language (IsiXhosa) and later translated to English by the research team from Dohne Agricultural Development Institute. The data collected from livestock owners included; household demographics, local name of medicinal plants, disease treated, dosage used and route of application, and the way respondents acquired the knowledge.

Plant specimens were identified and collected at Goso, Upper Ngqumeya and Ciko. The three study sites were selected purposely and due to the fact that they have many small-scale livestock farmers who have traditional knowledge on the use of medicinal plants. Plant specimens were preserved according to standard botanical practices and mounted on standard herbarium sheets (Victor et al., 2004) and later identified by pasture scientists in the Department of Rural Development and Agrarian Reform. These specimens are currently kept in the Herbarium, based at the Dohne Agricultural Development Institute.

Statistical analysis

Data were captured on Microsoft Excel 2013 and analyzed using

the Statistical Package for Social Science (SPSS, 2000) to generate descriptive statistics.

Plant taxonomy

Species names follow the plant list Ver 1.1 (<http://www.theplantlist.org/>) except for *Olea europaea* subsp. *africana*/*Olea Africana*, where the species name by Green and Kupicha (1979) sub-specific rank of *O. europaea* subsp. *africana* is retained.

Species distribution data was obtained via the Botanical Database of Southern Africa (SANBI, 2016). Distribution maps display quarter degree square (QDS) centroids for botanical records within the Botanical Database of Southern Africa.

RESULTS AND DISCUSSION

Demographic characteristics of respondents

The study revealed that out of forty-eight (48) respondents who had knowledge of medicinal plants, 31 (64.6%) were males and 17 (35.4%) were females (Table 1). The age of the respondents varied between 20 to 73

Table 1. Demographic characteristics of respondents.

Variables	Male	Female	
Gender	31 (64.6%)	17 (35.4%)	
	A	B	C
Age group (years)	20-40	41-60	>60
	14 (29.2%)	24 (50%)	10 (20.8%)

years and the majority were in the older age group (41 to 60 years).

A substantial percentage of younger people (29.2%) were involved in traditional livestock treatment. The results indicated that all the respondents (100%) were literate and more than 50% had primary education, 39.58% were junior high scholars and 4.16% had tertiary level education.

Plant species identified and collected

A total of six species of medicinal plants were collected and identified for the treatment of 2 bacterial cattle diseases (Table 2).

Identification of disease and associated symptoms

Various symptoms were reported for the two prevailing bacterial diseases. According to the farmers, bad smell from the carcass and stiff shoulder were symptoms related to Blackquarter, while lack of appetite and diarrhea were signs of perceived paratyphoid.

Sources of traditional medicinal knowledge

It was observed that inheritance of traditional knowledge of medicinal plants was a major source of knowledge acquisition (Figure 2). Vertical knowledge transmission from grandparents and parents was mentioned by 81% (39 respondents). However, horizontal transmission from uncle/aunt and neighbors was reported by 19% of the respondents (9).

Plant parts used

Among the plant parts used (Figure 3), leaves were the most commonly used (63.6%), followed by bark (26.4%) and roots (10%) in the preparation of traditional veterinary medicine. The method of preparation varied from individual to individual.

Preparation and application for specific diseases

Blackquarter

Different disease types were reported amongst which, blackquarter (75%) and perceived paratyphoid (25%) were the most common. Farmers reported that *Agapanthus praecox*, *Sarcophyte sanguinea* and *O. europaea* subsp *africana* are used to treat Black-quarter. *A. praecox* has the widest distribution of *Agapanthus* within the Eastern Cape. The geophyte habitat is typically on rock plates or rock outcrops in montane grassland (Pooley, 1998).

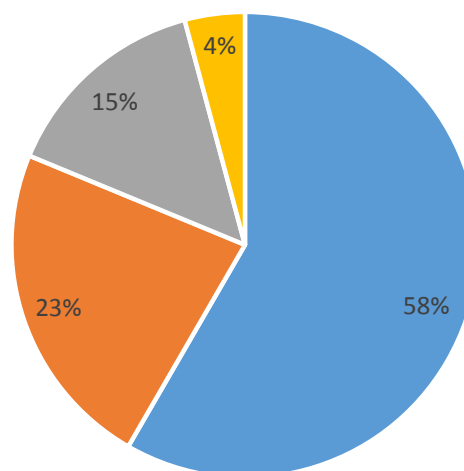
S. sanguinea is a root parasite on *Acacia* species resembling more a fungus than a flowering plant. It has a scattered distribution in Eastern Cape Savanna's. *O. europaea* ssp *africana* is one of the most widely occurring trees in South Africa and is associated with a variety of habitats from rocky hillsides, forest margins and riverine bush (Figure 4).

In the present study, a full hand of leaves and roots of *A. praecox* (Amaryllidaceae) were crushed, mixed and soaked on five cups of water overnight to make an infusion. On the following day the mixture was sieved into 750 ml bottles (daily dosage) and administered orally for 2 to3 days to treat blackquarter in Lusikisiki. In Keiskammahoek, a handful of *S. sanguinea* (Balanophoraceae) stems were dried, crushed and soaked on 5 L of warm water overnight and administered orally using a 750 ml bottle (dosage) fortnightly until the animal show some improvement, whereas the leaves of *O. europaea* subsp. *africana* (Oleaceae) in Mbhashe were crushed and mixed with 2 L of water for a day, later the mixture was sieved and drenched orally using 750 bottle (dosage) over a period of 3 days to treat black quarter.

The literature study also established that the same plants species used to manage blackquarter were also used to treat other diseases and conditions of man and livestock. For instance, Dold and Cocks (2001), reported that roots of *Agapanthus africanus* were used to treat diarrhoea in goats and sheep. The entire plant of *S. sanguinea* was used to treat diarrhoea and dysentery (Olajuyigbe and Afolayan, 2012). A study conducted by

Table 2. Plants used for treatment of bacterial diseases, plant parts(s) and mode of preparation and administration.

Disease treated and area collected	Botanical name	Family name	Vernacular name	Part(s) used	Mode of preparation and administration
Black quarter					
Goso (Lusikisiki)	<i>Agapanthus praecox</i>	Amaryllidaceae	Mavumbula	Roots and Leaves	Roots and leaves of <i>Agapanthus</i> were crushed and soaked with water and administered orally
Ciko (Mbhashe)	<i>Olea europaea africana</i>	Oleaceae	Umkhondo	Bark	Bark of <i>O. europaea africana</i> crushed and soaked with warm and administered orally
Upper Ngqumeya (Keiskammahoek)	<i>Sarcophyte sanguinea</i>	Balanophoraceae	Umnquma	Whole plant	Whole plant of <i>S. sanguinea</i> crushed with water and administered orally
Paratyphoid					
Goso (Lusikisiki)	<i>Dalbergia obovata</i>	Fabaceae	Izungu	Leaves	Leaves and bark crushed and mixed with water and administered orally
Ciko (Mbhashe)	<i>Strychnos henningsii</i>	Loganiaceae	Umnonono	Bark	
	<i>Acokanthera oppositifolia</i>	Apocynaceae	Isihlungusehlathi	Leaves	Leaves crushed with water and administered orally



■ Grand parents ■ Parents ■ uncle/Aunt ■ Neighbours

Figure 2. Source of knowledge acquisition.

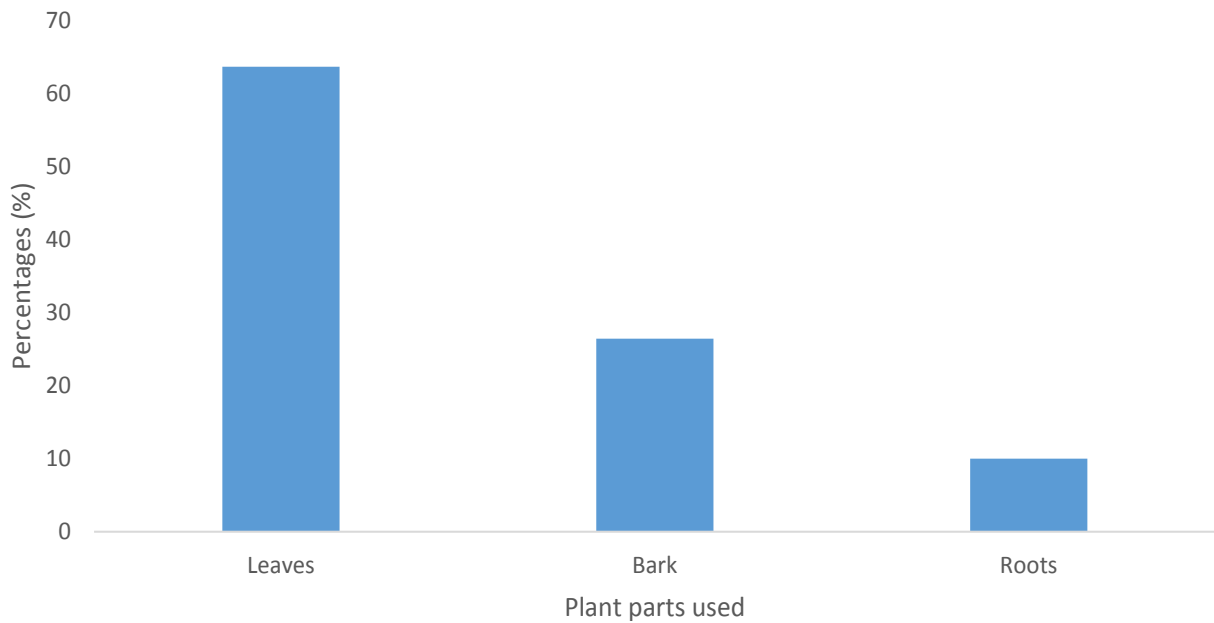


Figure 3. Plant parts used by the communities of Upper Ngqumeya, Ciko and Goso.

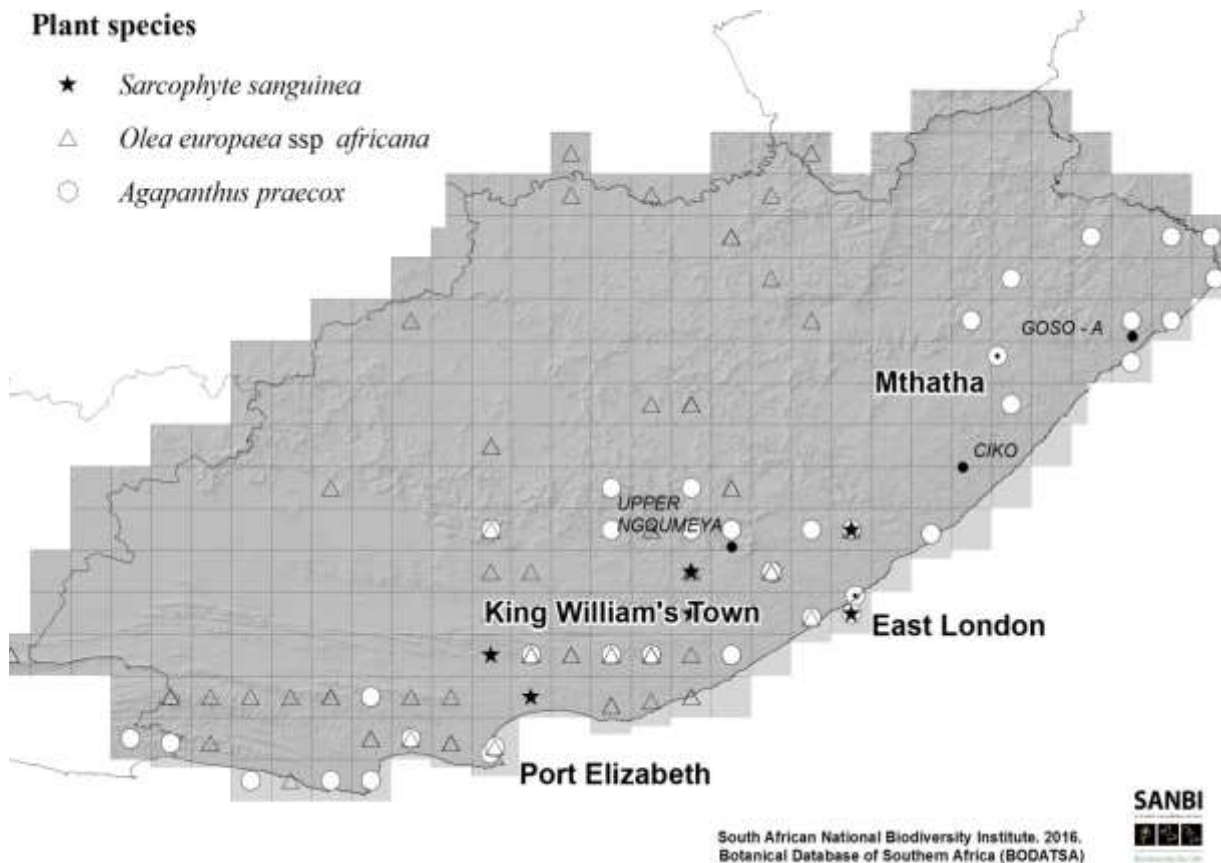


Figure 4. Species distribution for *Sarcophyte sanguinea*, *Olea europaea ssp africana* and *Agapanthus praecox* used to treat Back-quarter as ethno-veterinary by livestock farmers at Upper Ngqumeya, Ciko and Goso villages in the Eastern Cape. Localities represent QDS centroids based on the Botanical Database of Southern Africa (SANBI, 2016)

Hutchings et al., (1996). reported that *O. europaea* species were used in humans to treat diuretic problems, lowering blood pressure, urinary and bladder infections and sometimes used as a tonic for sore throat in humans. Veale et al. (1999) found that leaves of *A. africanus* exhibit agonistic activity on uterine muscarinic receptors and promote the synthesis of prostaglandins in the oestrogenised rat uterus. The use of *O. europaea* ssp *africana* to manage antibacterial diseases is consistent with the findings of Masoko and Makgapeetja (2015) that leaf extracts of *O. europaea* ssp *africana* contain compounds with antioxidant, antibacterial and antifungal activities.

Paratyphoid (as perceived by farmers)

Farmers indicated that *Strychnos henningsii*, *Acokanthera oppositifolia* and *Dalbergia obovata* are used by different communities to treat Paratyphoid. *S. henningsii* a potentially tall tree occurring in forests while dense bush occur from around the Kei River northwards with one of the six *Strychnos* species occurring in the Eastern Cape.

A. oppositifolia is a small tree or shrub growing along the Eastern seaboard and escarpment in various scrub, thicket or forest habitats up to 2000 m (Boon, 2010). *Dalbergia obovata* is a woody climber within medium altitude or coastal forest from East London northwards.

The leaves and bark of *S. henningsii*, *A. oppositifolia* and *D. obovata* were orally administered to treat paratyphoid in some district municipalities of the Eastern Cape. In Lusikisiki, a handful of leaves and bark of *S. henningsii* and *D. obovata* were crushed and mixed with water for 5 h and later drenched in 30 ml to manage paratyphoid in calves for 3 days. In Mbashe, ten leaves of *A. oppositifolia* were crushed with water and drenched at 375 ml per day for a period of 1 to 2 days.

In some studies, the bark of *S. henningsii* was crushed into a powdered form and half a cup of the decoction was administered orally to cure diabetes mellitus (Oyedemi et al., 2009). In other studies, *S. henningsii* was used for various ailments in traditional medicine including rheumatism, gynaecological complaints, abdominal pain, snake bite, gastrointestinal pain, malaria and diabetes (Hutchings, 1989; Bisset, 1970). Due to retuline-like alkaloids present in the plant, *S. henningsii* could be used for the development of new antinociceptive (anti-inflammatory and analgesic) and antispasmodic drugs (Tits et al., 1991).

The extract of leaves and bark of *D. obovata* were used to treat paratyphoid disease as recorded in the study. This differs from the findings of Louppe et al. (2008), who recorded that the root infusion was used to cure stomach-ache and toothache in humans. Pooley (1993), reported that bark was used to treat mouth sores topically in babies. Other studies reported that the dried leaves or

roots and wood were used as anthelmintics in animals (Hutchings et al., 1996; Van Wyk et al., 1997). Root decoctions of *A. oppositifolia* were used to treat pain and diarrhea (Maphosa et al., 2010). Van Wyk et al., (2002) reported that *A. oppositifolia* and *A. oblongifolia* contain major toxic components of cardiac glycosides and Acovenoside.

Conclusion

Six plant species were recorded and reported to be used for the treatment of bacterial livestock diseases in certain areas of the Eastern Cape. This study showed that traditional medicine, which mainly involves the use of medicinal plants do play an important role in addressing the healthcare needs of developing farmers in the Eastern Cape. The use of medicinal plants to control and manage livestock diseases in most rural areas of the Eastern Cape need to be quantify based on the efficacy, active ingredients and standardization of dose and dosing protocol in order to be used effectively. These plants were collected from the wild and the exploitation and over-harvesting thereof may lead to the loss of certain plant species if not managed responsibly.

The study also indicates that communities use specific species to treat veterinary diseases although plants species used by other small scale farmers may also be present in the area. With the exception of *O. europaea* ssp *africana* which has a wider habitat distribution, other five species are habitat specific and in some cases less common e.g. *S. henningsii*. Further studies are needed to substantiate the potential use of these 6 species ethno-veterinary medicine.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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REFERENCES

Asiimwe S, Namutebi A, Borg-Karlssoon A, Mugisha MK, Oryem-Oringa H (2014). Documentation and consensus of indigenous

- knowledge on medicinal plants used by local communities of western Uganda. *Journal of Natural Product and Plant Resource*, 4(1):34-42.
- Bisset NG (1970). The African species of *Strychnos*. *The ethnobotany. Lloydia*, 33:201-243.
- Boon R (2010). *Pooley's Trees of Eastern South Africa: A Complete Guide*. Flora and Fauna Publications Trust.
- Dangwal LR, Rana CS, Sharma A (2011). Ethno-medicinal plants from transitional zone of Nanda Devi Biosphere Reserve, District Chamoli, Uttarakhand (India). *Indian Journal Nature Production Resource*, 2(1):116-120.
- Dragoeva AP, Koleva VP, Nanova ZD, Koynova TV, Jordanova PK (2015). A study of current status of herbal utilization in Bulgaria: Part 1- Application of herbal medicines. *Science Resource Essays*, 10(5):168-176.
- Duguma B, Yisehak K, Janssens GPJ (2012). Survey of major diseases affecting dairy cattle in Jimma town, Oromia, Ethiopia. *Global Veterinary*, 8(1):62-66.
- Green PS, Kupicha FK (1979). Notes on the genus *Olea*. *Kew Bulletin*, 34(1):69-75.
- Haile Y, Delenashaw Y (2007). Traditional medicinal plant knowledge and use by local healers in Sekoru District, Jimma Zone, Southern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 3(1):24.
- Harun-or-Rashid MD, Tanzin R, Ghosh KC, Jahan R, Khatun A, Rahmatullah M (2010). An ethno-veterinary survey of medicinal plants used to treat cattle diseases in Birishiri area, Netrakona district, Bangladesh. *Advances in Natural and Applied Sciences*, 4(1):10-14.
- Hutching A (1989). A survey and analysis of traditional medicinal plants used by the Zulu, Xhosa and Sotho. *Bothalia*, 19(1):112-123.
- Hutchings ASA, Lewis G, Balfour A (1996). *Zulu Medicinal Plants. An inventory*, University of Natal Press, Pietermaritzburg. pp. 37-235.
- Jabbar A, Akhtar MS, Muhammad G, Lateef M (2005). Possible role of ethno-veterinary medicine in poverty reduction in Pakistan: Use of botanical Anthelmintics as an example. *Journal of Agriculture and Social Sciences*, 1(2):187-195.
- Kiff E, Thorne P, Pandit BH, Thomas D, Amatya SM (1999). Livestock production systems and the development of fodder resources for the mid hills of Nepal. *Natural Resources Institute (NRI)*, Chatham, UK. P 7.
- Lans C, Turner N, Khan T, Brauer G (2007). Ethnoveterinary medicines used to treat endoparasites and stomach problems in pigs and pets in British Columbia, Canada. *Veterinary Parasitology*, 148(3-4):325-340.
- Livestock Statistics, 2015. Department of Agriculture Forestry and Fisheries. Available at: <http://www.daff.gov.za/daffweb3/Home/CropEstimates/Statistical-Information/Livestock>
- Luseba D, Tshisikhawe MP (2013). Medicinal plants used in the treatment of livestock diseases in Vhembe region, Limpopo Province, South Africa. *Journal of Medicinal Plants Research*, 7(10):593-601.
- Mahwasane ST, Middleton L, Boaduo N (2013). An ethnobotanical survey of indigenous knowledge on medicinal plants used by the traditional healers of the Lwamondo are, Limpopo Province, South Africa. *South African Journal of Botany*, 88:69-75.
- Maphosa V, Masika PJ, Moyo B, (2010). Toxicity evaluation of the aqueous extract of the rhizome of *Elephantorrhiza elephantina* (Burch) Skeels.(Fabaceae), in rats. *Food and chemical toxicology*, 48(1):196-201.
- Masika PJ, Afolayan AJ (2003). An ethnobotanical study of plants used for treatment of livestock diseases in the Eastern Cape Province, South Africa. *Pharmaceutical Biology*, 41(1):16-21.
- Masika PJ, van Averbek W, Sonandi A (2000). Use of herbal remedies by small-scale farmers to treat livestock diseases in central Eastern Cape Province, South Africa. *Journal of the South African Veterinary Association*, 71(2):87-91.
- Masoko P, Makgapeetja DM (2015). Antibacterial, antifungal and antioxidant activity of *Olea africana* against pathogenic yeast and nosocomial pathogens. *BMC Complementary Alternative Medicine*, 15(1):409.
- Moyo B, Masika PJ (2009). Tick control methods used by resource-limited farmers and the effect of ticks on cattle in rural areas of the Eastern Cape Province, South Africa. *Tropical Animal Health and Production*, 41(4): 517-523.
- Mucina L, Rutherford MC, Powrie L (2005). *Vegetation map of South Africa, Lesotho and Swaziland*. SANBI, Pretoria.
- Njoroge GN, Bussmann RW (2006). Herbal usage and informant consensus in ethno-veterinary management of cattle diseases among the kikuyus (Central Kenya) *Journal Ethnopharmacology*, 108:332-339.
- Pooley E (1993). *complete field guide to trees of Natal, Zululand & Transkei*. Natal Flora Publications Trust.
- Pooley B (1998). *A field guide to wild flowers of KwaZulu-Natal and the eastern region*. Durban: Natal Flora Publications Trust 630 p.
- South African National Biodiversity Institute (2016). *Botanical Database of Southern Africa (BODATSA)*. SANBI, Pretoria. Available at: <http://newposa.sanbi.org/>
- Shen S, Qian J, Ren J (2010). Ethnoveterinary plant remedies used by Nu people in NW Yunnan of China. *Journal of Ethnobiology and Ethnomedicine*, 6(1):24.
- Teklehaymanot T, Giday M (2007). Ethno botanical study of medicinal plants used by people in Zegie peninsula, North Western Ethiopia *Journal of Ethnobiology and Ethnomedicine*, 3(1):12.
- Tits M, Damas J, Quetin-Leclercq J, Angenot L (1991). From ethnobotanical uses of *Strychnos henningsii* to antiinflammatories, analgesics and antispasmodic. *Journal Ethnopharmacology*, 34(2):261-271.
- Van der Merwe D, Swan GE, Botha CJ (2001). Use of ethno-veterinary medicinal plants in cattle by Setswana-speaking people in the Madikwe areas of the North West Province of South Africa. *Journal South Africa Veterinary Association*, 72:189-196.
- Van Wyk BE, Oudtshoorn BV, Gericke N (1997). *Medicinal Plants of South Africa*. Briza.
- Van Wyk AE, Smith GF (2001). *Regions of floristic endemism in southern Africa: a review with emphasis on succulents*. Umdaus press.
- Van Wyk BE, Van Heerden FR, Van Oudtshoorn B (2002). *Poisonous plants of South Africa*. Briza Publications.
- Veale DJ, Havlik I, Oliver DW, Dekker TG (1999). Pharmacological effects of *agapanthus africanus* on the isolated rat uterus. *Journal Ethnopharmacology*, 66(3):257-256.
- World Health Organisation (WHO) 2010. *Climate change and human health*. Available at: <http://www.who.int/globalchange/ecosystem/biodiversity/en/index.html>

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