

Review of Ethnoveterinary Medicine for Animal Healthcare in Nigeria

Onwubiko J.I, Igwillo U.C. ^{*1}, Mbaoji C.O., Ifreke L.M. ²

Nigeria Natural Medicine Development Agency, Lagos, Nigeria.

*Corresponding author's email: ugoigwillo@yahoo.com

Abstract: Poor animal health is a major problem limiting livestock productivity in sub-Saharan Africa including Nigeria. Decline in funding veterinary services, animal health and cost of veterinary medicines and services have pushed poor, rural farmers to search for alternative medicine. Ethnoveterinary medical practices play important roles in animal healthcare system in Nigeria. This work was done to provide information on some medicinal plants that are used to treat animal diseases in Nigeria. Previous works were critically reviewed in order to identify relevant information on the medicinal plants used to treat poultry, large and small animal diseases by livestock farmers in Nigeria such as: pasteurellosis, fowl cholera, Newcastle disease, foot-and-mouth disease, helminthiasis, dermatomycosis, trypanosomiasis, poisoning, dysentery, diarrhea, oedema, inflammation, skin infection, ectoparasites infestations, etc. The plant names (scientific, English, local), plant parts, therapeutic regimens, phytochemical principles and associated diseases were recorded. The aim was to boost animal healthcare and productivity by providing useful information from identified medicinal plants which can be used in treatment and management of various animal diseases in Nigeria.

Keywords: Ethnoveterinary medicine, Livestock, Medicinal plants, Diseases, Animal healthcare.

1. INTRODUCTION

The relationship between man and animals with plants obviously originated with the beginning of life on earth, when plants supplied much of the shelter, oxygen, food and medicine needed by higher life forms. Overtime man learned to recognize and categorize plant materials suited for use in meeting the necessities of life. Of these necessities, the use of herbs and herbal extracts to enhance health can be traced to the earliest of folklore, traditions and writings that were codified and used for their ability to ease pain and treat diseases. The evolution of this bioresource-based medicinal system, primarily based on plants within a local area, produced the well-known traditional medicine systems (Mamedov, 2012). According to World Health Organization (WHO, 2019), traditional medicine is the sum total of the knowledge, skill and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness. Furthermore, Jabbar *et al.*, (2005) reported that at least 80% of the world's population (especially in developing countries) relies on medicinal plants for their primary health care needs, and for control and treatment of various diseases affecting livestock. In addition, about 35,000 to 70,000 medicinal plants species have been used as medicines. This figure corresponds to 14-28% of the 250,000 medicinal plants species estimated to occur around the world (Mamedov, 2012). Ethnoveterinary medicine is the holistic, interdisciplinary study of local knowledge and its associated skills, practices, beliefs, practitioners and socio-cultural structures and environment associated with and pertaining to the healthcare and healthful husbandry of food, work, and other income-producing animals, always with an eye to practical development of applications within livestock production and livelihood systems, and with the ultimate goal of increasing human wellbeing through increased benefits from stock raising (Okoli *et al.*, 2002; Uwagie-Ero *et al.*, 2017). Ethnoveterinary practice is widespread among herders and local livestock producers. Traditional remedies in this area include use of herbs extracts from different medicinal plant parts. In Nigeria, the use of herbal extract in animal husbandry is gaining prominence among livestock owners either due to lack of access

to conventional care, high cost of orthodox medicines, increasing adverse effects, lack of trained manpower or the held belief that herbal remedies are more efficacious (Offiah *et al.*, 2011).

In Nigeria and most developing countries, animal disease remains one of the leading causes of poor livestock health and production; this creates an ever-increasing gap between the supply and demand for livestock products. Livestock entrepreneurs are often faced with the challenge of unavailability of orthodox drugs, fake/adulterated drugs, high costs of orthodox drugs or trained veterinary services and these often make them to seek alternatives by turning to indigenous systems of animal health care. The shortage in the number of trained manpower in veterinary services is resulting in limited service coverage to livestock farmer in developing countries. Hence, they regularly visit traditional healers or indigenous knowledge holders to get solutions for their sick animals (Gebremedhin *et al.*, 2015).

Poor animal health is still a major problem limiting livestock productivity in sub-Saharan Africa including Nigeria. According to Offiah *et al.*, (2011), it is documented that humans utilize the same herbal preparations that they use to treat their sick animals. As a result, farmers are known to treat animal diseases with herbs even before the advent of orthodox medicine. Ethnoveterinary practices remain relevant and vital in many areas in Nigeria due to absence or inadequate provision of modern medical services particularly in rural areas or during emergency cases. Therefore, in order to maintain healthy livestock industry traditional healing practices have been used for centuries from generation to generation (Phondani *et al.*, 2010). The importance of indigenous ethnoveterinary practices cannot be over emphasized, though this knowledge is not documented and is dwindling fast (Yinegar *et al.* 2007). It is also a fact that ethnomedicinal knowledge is on the verge of decline due to sparse effort in documentation of the oral tradition transmitted across generations (Matekaire and Bwakura, 2004). This situation is being worsened by rapid socio-economic, technological and environmental changes posing significant threat to the future wellbeing of human and animal populations that have relied on these resources to combat various health conditions for ages. Therefore, to document, promote and conserve Nigeria's ethnoveterinary biodiversity is a timely intervention. Sourcing of ethnoveterinary medicine is relatively easy as the raw materials - mainly wild or cultivated medicinal plants - are freely available or they can be provided at little cost from the growers. Ethnoveterinary medicine is well tolerated and effective with less adverse effects while resistance is yet to be recorded when compared to alternative modern veterinary medicine and can be administered by anyone with good knowledge as no western knowledge is required (Uwagie-Ero *et al.*, 2017).

Over the years, scientists have recorded medicinal plants used in treating animal diseases in Nigeria. For example, Saganuwan (2017) recorded sixty-eight tropical plants that are used to treat poultry diseases in Nigeria and twenty-two tropical plants used to treat small animal diseases in Nigeria. Uwagie-Ero *et al.*, (2017) listed forty-five medicinal plants used for treatment of animal diseases in Nigeria. Offiah *et al.*, (2011) listed fifty-seven medicinal plants used in treatment of animal diarrhea in Nigeria. Alawa *et al.*, (2002) outlined some ethnoveterinary medical practice for ruminants in the northern Nigeria. Ayeni and Basiri (2018) presented a surveyed result of ethnoveterinary plants used in treating livestock among the Fulani people of Girei, Adamawa State of Nigeria. The survey identified thirty medicinal plants species and the different livestock disease conditions they treat. Adeniran *et al.*, (2020) documented thirty-one medicinal plants used in ethnoveterinary practices in the Federal Capital Territory in North-Central geopolitical zone of Nigeria. Similarly, Chah *et al.*, (2009) identified twelve plant species for the treatment of seventeen diseases in small ruminants in the Eastern Guinea Savanna region of Nigeria.

It is important to note that ethnoveterinary practice is not limited to Nigeria but widespread in other African nations. For example, Marandure (2016) reviewed the application of concepts and key issues of ethnoveterinary medicine in Zimbabwe. Luseba and Tshisikhawe (2013) listed medicinal plants used in the treatment of livestock diseases in Vhembe region of South Africa. Birhanu and Abera (2015) surveyed twenty-five ethnoveterinary medicinal plants in Horro Guduru District of Western Ethiopia. Earlier, Minja (1994) reported one hundred and three medicinal plant species from forty-eight families used in the promotion of animal health in Tanzania. Similarly, Dzoyem *et al.*, (2020) recorded one hundred and thirty-eight plants that are used in Cameroon to manage livestock diseases, and maintained that an overwhelming majority of animal owners in Cameroon rely on traditional healthcare practices to keep their animals healthy and to treat them when they are sick.

Apart from Africa, ethnoveterinary medicine is also applicable in other countries. For example, Saikia and Borthakur (2010) listed twenty medicinal plants used in animal healthcare from Gophur, India. Similarly, Panda *et al.*, (2017)

outlined forty-four plant species for ethnoveterinary practices to remedy twenty-three types of animal ailments in India. Aziz *et al.*, (2018) identified seventy-three medicinal plants for traditional and veterinary practices in Pakistan. Again, Aziz *et al.*, (2020) reported four hundred and seventy-four plant species corresponding to two thousand three hundred and eighty-six remedies which are used to treat domestic animals in Pakistan. In addition, Suroowan *et al.*, (2017) reviewed ethnoveterinary health management practices using medicinal plants in South Asia and found that two hundred and seventy-six plants are used for managing fourteen categories of animal diseases.

Table 1 shows a list of some tropical plants used to treat animal diseases in Nigeria, adopted from Saganuwan (2017).

Table 1: Tropical plants used to treat animal diseases in Nigeria

S/n	Family, Scientific & common Name(s)	Vernacular names	Part(s) used	Therapeutic regimen(s)	Phytochemical principles	Animal disease (s)	Reference
1.	Fabaceae <i>Acacia nilotica</i> (L.) Wild ex Delile (Babul)	Bagaruwa (H) Gabaruwa (N) Booni (Y)	Dried bark, fruits, and seed	Infusion of pounded plant parts used to wash affected parts.	Gallotannins, catechins	Foot-and-mouth disease.	Saganuwan, 2010.
2.	Rubiaceae <i>Gardenia erubescens</i> Stapf & Hutch (Gardenia)	Gaude (H) Dingali (F)	Seeds, root seed	Powder with egret and chicken faeces	Crocin, tannin	Foot-and-mouth disease.	Saganuwan, 2010.
3.	Papilionaceae <i>Vigna unguiculata</i> Linn. (Cowpea)	Wanke (H) Agwa (I) Ezo (N) Ewa (Y)	Seeds, flower	The powder with egret and chicken faeces	Proteins	Foot-and-mouth disease, oedema, inflammation.	Mann <i>et al.</i> , 2003.
4.	Asteraceae <i>Vernonia amygdalina</i> Del. (Bitter leaf)	Shiwaka (H) Ewuro (Y) Tsula (N) Onugbu (I)	Leaves	The powder mix with salt and infusion is given often.	Vernodaline, Vernolepin, Vernomygdin, tannins, saponin, vitamin C, Root is toxic.	Helminthosis, bacterial infection	Saganuwan <i>et al.</i> , 2007, Saganuwan, 2010.
5.	Meliaceae <i>Khaya senegalensis</i> Desr. A. Juss (Mahogany tree)	Madachi (H) Ono (I) Dalchi (F) Wuchi (N) Oganwo (Y)	Bark, seed oil	The powder with potash is bran give: root powder is applied topically	Limonoid, safoletin, tannins, saponins, sterols, manganese	Helminthosis, bacterial infection, ectoparasites infestation Trypanosomosis, dysentery	Saganuwan, 2010. Adamu <i>et al.</i> , 2012.
6.	Meliaceae <i>Azadirachta indica</i> A. Juss (Neem tree)	Nimu (N), Dogonyaro (I) Dongoyaro (H)	Bark, oil	Infusion of the powder with potash or salt given; oil is rubbed	Nimbin, azadiractin, salamin, meliacin, limbolide	Helminthosis, sarpcoroptic, psoroptic mange, inflammation	Saganuwan & Uko 2005. Saganuwan, 2010. Adamu <i>et al.</i> , 2012
7.	Sapotaceae <i>Vitellaria paradoxa</i> C.F. Gaertn (Shea butter tree)	Kadanya (H) Karerevi (F) Ori (Y) Kochi (N)	Bark	Infusions or Decoction given	Fixed oils, alkaloids	Helminthosis dermatomycosis, poisoning, dysentery, diarrhea.	Saganuwan <i>et al.</i> , 2010. Adamu <i>et al.</i> , 2012
8.	Verbanaceae <i>Vitex doniana</i> Thonn. (Black plum)	Dinya (H) Dinchi (N) Oriri (Y)	Bark, leaves, fruits	Decoction is given to calves	Arylglycoside	Helminthosis, skin infection, colic, dysentery, diarrhea.	Saganuwan, 2010.
9.	Curcubitaceae <i>Momordica balsamina</i> Linn. (Balsam pear)	Garahuni (H) Ejinrin (Y) Ibuzo akban Ndene (I) Garafini (N)	Leaves	Powder mixed with the cattle urine or the infusion is given to calves	Momordicine, glutelin, albumin, globulin, aminobutyric acid	Helminthosis	Saganuwan, 2010.

Adopted from: Saganuwan (2017).

Keys: Nupe (N), Igbo (I), Yoruba (Y), Hausa (H), Fulfulde (F), - = No information

Table 2 shows some commonly used plants in ethnoveterinary medicine in Nigeria adopted from Uwagie-Ero *et al.*, (2017).

Table 2: Some commonly used plants in ethnoveterinary medicine in Nigeria

S/n	Family, Scientific & Common Name (s)	Vernacular Names	Part (s) used	Disease cured	Application	Reference
1.	Fabaceae <i>Acacia albida</i> / <i>Faidherbia albida</i> . (Delile) A. Chev. (Apple ring acacia)	Gawo (H)	Leaves	Stuffy eye	Macerate in water and drench animal.	Marandure 2016.
2.	Fabaceae <i>Acacia nilotica</i> (L.) Wild ex Delile (Babul)	Bagaruwa (H) Gaboruwa (N) Booni (Y)	Dried bark. Fruits and seeds	Foot and mouth disease	Infusion of pounded plant parts used to wash affected parts.	Marandure, 2016.
3.	Bombacaceae <i>Adansonia digitate</i> Linn. (Baobab)	Ose (Y) Igiöse (I) Kukaa/Kulambali (H)	Fruits	Fowl cholera	Powder mixed with feed.	Marandure, 2016. Mann <i>et al.</i> , 2003. Sofowora, 1993
4.	Alliaceae <i>Allium sativum</i> Linn. (Garlic)	Aayi (Y) Ayo-ishi (I) Tafarunua (H)	Leaves	Pasteurellosis	Decoction is given to animals.	Marandure, 2016. Sofowora, 1993. Saganuwan, 2010. Mann <i>et al.</i> , 1997.
5.	Alliaceae <i>Allium cepa</i> Linn. (Onion)	Alubosa (Y) Alu-bosa (I) Albasa (H)	Bulb	Pasteurellosis, cowdriosis	Decoction is administered to affected animals.	Marandure, 2016. Mann <i>et al.</i> , 2003. Iwu, 1993.
6.	Anacardiaceae <i>Anacardium occidentale</i> Linn. (Cashew)	Kaju (Y) Sas-hu (I) Kanju (H)	Leaves, seed.	Diarrhea, infertility. Arthritis, hepatitis	The powder is mixed with animal feed, smoke repel of kill insects.	Marandure, 2016. Mann <i>et al.</i> , 2003. Sofowora, 1993.
7.	Annonaceae <i>Annona senegalensis</i> Pers. (Wild custard apple)	Uburu-ocha (I) Abo (Y) Gwander daajii (H)	Leaves	Antibiotics	Macerate in water and administer orally to the animal.	Marandure, 2016. Mann <i>et al.</i> , 2003. Sofowora, 1993.
8.	Annonaceae <i>Annona muricata</i> Linn. (Soursop)	Sawamsop (I)	Root	Pediculosis, helminthosis, pasteurellosis, lousiness, cough, trypanosomosis, diarrhea, dysentery.	Decoction is prepared with root of <i>T. indica</i> and <i>A. senegalsensis</i> and given to animals.	Marandure, 2016. Mann <i>et al.</i> , 2003, Sofowora, 1993.
9.	Fabaceae <i>Arachis hypogea</i> Linn. (Groundnut)	Ahuekele (I) Epa (Y) Ayayaa (H)	Oil	Poisoning	Oil is given to the poisoned birds to drink.	Marandure, 2016. Mann <i>et al.</i> , 2003. Sofowora, 1993.
10.	Meliaceae <i>Azadirachta indica</i> A. Juss. (Neem tree)	Dongoyaro (Y) Ogwuakom (I) Maina (H)	Barks	Helminthosis, dermatomycosis, poisoning, dysentery, diarrhea.	Bark infusion or decoction is given.	Marandure, 2016. Sharma <i>et al.</i> , 1967. Adamu <i>et al.</i> , 2012.
11.	Cannabaceae <i>Cannabis indica</i> Lam. (Hemp plant)	Wiyiwiyi (N) Bakalele/Bakare kare (H)	Leaves	Newcastle disease	The leave are soaked in drinking water.	Mann <i>et al.</i> , 2003. Saganuwan, 2010
12.	Rutaceae <i>Citrus aurantifolia</i> (Christm) Swingle. (Lime)	Oloma nkirisi (I) Osan wewe (Y) Karemi lemu (H)	Leaves	Diarrhoea	Give the liquid extract to animal orally until symptoms disappear.	Mann <i>et al.</i> , 2003. Iwu, 1993. Saganuwan, 2010.

13.	Rutaceae <i>Citrus aurantium</i> Linn. (Bitter orange)	Lemu maizaki (H) Lemu nasara (N)	Root, Bark	Trypanosomosis	Mix the powder with butter and apply through the anus.	Mann <i>et al.</i> , 2003. Sofowora, 1993. Saganuwan, 2010
14.	Papilionaceae <i>Desmodium velutinum</i> (Willd.) DC. (Velvet leaf)	Dankadafi (H) Emo/ Eeno (Y) Labalabangi (N)	Whole of the shoot	Abortion	Decoction with potash given to animal.	Marandure, 2016. Mann <i>et al.</i> , 2003 Sofowora, 1993.
15.	Dioscoreaceae <i>Dioscorea dumetorum</i> (Kunth) Pax. (Bitter yam)	-	Root	Blindness	Pound extract with water and drop into the eye.	Ademola <i>et al.</i> , 2005
16.	<i>Echinochloa pyramidalis</i> Lam. Hitche. And Chase (Antelope grass)	Sabe (H) Kabadoko (N)	Whole plant	Mastitis	Decoction is used to wash the affected Udder	Mann <i>et al.</i> , 2003. Sofowora, 1993. Iwu, 1993.
17.	Aracaceae <i>Elaeis guineensis</i> Jacq. (African palm oil)	Aku (I) Ekuro (Y) Kwakwa (H)	Fresh peels	Psoroptic mange	The Oil of <i>E. guineensis</i> is rubbed followed by rubbing of fresh peels.	Marandure, 2016. Mann <i>et al.</i> , 2003. Iwu, 1993
18.	Euphorbiaceae <i>Euphorbia poissonii</i> Pax. (Dogs thorn)	Oro elewe (Y) Tinyaa (H)	Latex	Sore, wounds	Latex is rubbed on sore, wound or any fresh cut.	Iwu, 1993, Dalziel, 1996. Gbile, 1986.
19.	Moraceae <i>Ficus exasperate</i> Vahl. (Fig tree)	Ogbu (I) Oporo/Opoto (Y) Achedinnmi (H)	Leaves	Fever / Malnutrition	Mash leaves, mix with water, give the liquid extract to animal.	Ademola <i>et al.</i> , 2005.
20.	Moraceae <i>Ficus platyphylla</i> Del. (Broad leaf fig)	Afomo (Y) Gamiji (H) Dzurugi (N)	Bark	Bovine, contagious, pleuropneumonia	Dry/pound the bark into powder and add salt, administer daily orally.	Ademola <i>et al.</i> , 2005.
21.	Malvaceae <i>Abelmoschus esculentus</i> (L.) Moench (Okra)	Okwuru (I) Ila/Ilasa (Y) Kubewa (H)	Stem	Placenta ejection	Pound dry stem/add water. Drench the animal with liquid.	Ademola <i>et al.</i> , 2005.
22.	Meliaceae <i>Khaya anthotheca</i> (Welw.) C. DC. (White Mahogany)	-	Stem bark	Haematuria, Dermatophilosis, babesiosis, facioliasis, scours	The white powder is mixed with feed.	Sofowora, 1993. Iwu, 1993
23.	Anarcadiaceae <i>Mangifera indica</i> Linn. (Mango)	Mangolo (I) Mangoro (Y) Mangwaro (H)	Leaves/Bark Roots	Diarhoea, Rinderpest, Ringworm, Scabies.	Grind leaves/bark, mix with water and give animal.	Ademola <i>et al.</i> , 2005.
24.	Moringaceae <i>Moringa Oleifera</i> Lam. (Drumstick tree)	Okwe oyibo (I) Ewe ile (Y) Zogale (H)	Leaves, stalks	Dystocia	Decoction is given to animal during labour.	Marandure, 2016. Mann <i>et al.</i> , 2003. Sofowora, 1993. Iwu, 1993.

Adopted from: Uwagie-Ero *et al.*, (2017).

Keys: Nupe (N), Igbo (I), Yoruba (Y), Hausa (H), - = No information.

2. CONCLUSION

Nigeria is richly endowed with rich ethnoveterinary bioresources widely distributed in all habitats across the nation and with adequate indigenous medical knowledge of utilizing them for a healthy animal population, combat diseases and to create wealth. Natural medicines and products made from medicinal plants and administered appropriately usually produce good results with minimal side effect (if any). Therefore, in order to sustain this practice more attention should be paid to developing ethnoveterinary practice in Nigeria through documentation and conservation of our biodiversity and traditional knowledge systems. This effort will make more natural products available, accessible and affordable to the livestock farmers, animal owners and herders as good alternative to orthodox medicines and products. Hence, it is very importance to evaluate, utilize, document, promote and integrate the numerous benefits of ethnoveterinary animal

healthcare practices into current primary livestock health care delivery service in Nigeria. Moreover, it is needful to preserve the chain of transfer of ethnoveterinary knowledge from generation to generation by proper and very detailed documentation. This is necessary because majority of the custodians of indigenous traditional knowledge are aged and often unlearned, inaccessible and neglected.

3. RECOMMENDATIONS

A comprehensive database of ethnoveterinary medicinal plants and ethnoveterinary practices in different States of Nigeria is highly recommended. Ethnoveterinary medicines need to be developed into over-the-counter drugs which can be sold in different parts of the country especially where urbanization has made access to the medicinal plants difficult. Massive cultivation, conservation and preservation of these ethnoveterinary medicinal plants especially the endangered species that are at the verge of extinction is also recommended. Government intervention is also recommended in order to make necessary policies that will guard against animal grazing, human activities e.g. bush burning, deforestation, etc which will be necessary in conservation of medicinal plants and preservation of ethnoveterinary biodiversity of Nigeria. Finally, further research work is recommended to be done concerning the efficacy, potency, pharmacological and toxicity studies of ethnoveterinary medicines in Nigeria.

REFERENCES

- [1] Adamu M, Naidoo V, Eloff JN. (2012). The antibacterial activity, antioxidant activity and selectivity index of leaf extracts of thirteen South African tree species used in ethnoveterinary medicine have excellent antifungal activities. *BMC Complem Alterna Med.* 12: 213-225.
- [2] Ademola IO, Fagbemi BO, Idowu SO. (2005). Anthelmintic activity of extract of *Spondias mombin* against gastrointestinal nematodes of sheep; studies in vitro and in vivo. *Tropical Ani Health Pro.* 37: 223-235.
- [3] Adeniran LA, Okpi S, Anjorin TS, Ajagbonna OP. (2020). Medicinal plants used in ethnoveterinary practices in the Federal Capital Territory, North-Central Nigeria. *Journal of Medicinal Plants Research.* 14(8): 377-388.
- [4] Alawa JP, Jokthan GE, Akut K. (2002) Ethnoveterinary medical practice for ruminants in the sub humid zone of northern Nigeria. *Preventive Veterinary Medicine.* 54: 79-90.
- [5] Ayeni EA, Basiri B. (2018). Ethnoveterinary survey of plants used in treating livestock among the Fulani people of Girei, Adamawa State, Nigeria. *World News of Natural Sciences.* 16: 53-66.
- [6] Aziz MA, Khan AH, Adnan M. (2018). Traditional uses of medicinal plants used by indigenous communities for veterinary practices at Bajaur Agency, Pakistan. *J Ethnobiology Ethnomedicine.* 14: 11.
- [7] Aziz MA, Khan AH, Pieroni A. (2020). Ethnoveterinary plants of Pakistan: a review. *J Ethnobiology Ethnomedicine.* 16: 25.
- [8] Birhanu T, Abera D. (2015). Survey of ethno-veterinary medicinal plants at selected Horro Gudurru District Western Ethiopia. *African Journal of Plant Science.* 9(3): 185-192.
- [9] Chah JM, Igbokwe EM, Chah KF. (2009). Ethnoveterinary medicine used in small ruminant health in the Eastern Guinea Savanna, Nigeria. *Livestock Research for Rural Development.* 21: 12.
- [10] Dalziel JK. (1996). Local treatment of ear mite infestation in a colony of rabbits in the mild hills of Western Nepal. *Vet Rev Kath.* 11: 30-45.
- [11] Dzoyem J, Tchuenguem R, Ibrahim M, Nkeza A, Roland A, Njouendou J, Assob J. (2020). Ethnoveterinary medicine and medicinal plants used in the treatment livestock diseases in Cameroun. *Ethnoveterinary Medicine.* 175-209.
- [12] Gbile ZO. (1986). Ethnobotany taxonomy and conservation of medicinal plants. In: Sofowora A. ed. *The State of Medicinal Plants Research in Nigeria*, U.I press, Nigeria. 13-29.
- [13] Gebremedhin RE, Tewedros AD, Lidet BT, Daniel FB. (2015). Ethnoveterinary medicinal plants: preparation and application methods by traditional healers in selected districts of southern Ethiopia. *Vet World.* 8(5): 674-684.

- [14] Iwu MM. (1993). Handbook of African Medicinal Plants. CRC press, Boca Ragin, Fl. 435.
- [15] Jabbar A, Akhtar MS, Muhammed G, Lateef M. (2005). Possible role of ethnoveterinary medicine in poverty reduction in Pakistan: use of botanical anthelmintics as an example. Journal of Agriculture and Social Sciences. 1 (2): 187-195.
- [16] 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.
- [17] Mamedov N. (2012). Medicinal plants studies: history, challenges and prospective. Med Aromat Plants. 1: 1-2.
- [18] Mann A, Abalaka ME, Garba SA. (1997). Antimicrobial activity of the leaf extract of Calotropis procera. Biochem Lett. 55: 205-210.
- [19] Mann A, Gbate M, Nda Umar A. (2003). Medicinal and economic plants of Nupeland. Jube Evans Books and publication, Bida, Nigeria. 3-276.
- [20] Mann A, Ibrahim K, Oyewale AO, Amupitan JO, Fatope MO, Okogun JI. (2012) Isolation and elucidation of three triterpenoids and its antimycobacterial activity of Terminalia avicennioides. Am J Org Chem. 2: 14-20.
- [21] Marandure T. (2016). Concepts and key issues of ethnoveterinary medicine in Africa: a review of its application in Zimbabwe. Afr J Agric Res 11: 1836-1841.
- [22] Matekaire T, Bwakura TM. (2004). Ethnoveterinary medicine: a potential alternative to orthodox animal health delivery in Zimbabwe. J Appl Res Vet Med. 2: 269-273.
- [23] Minja MMJ. (1994). Medicinal plants used in the promotion of animal health in Tanzania. Rev. Sci. Tech. Off. Int. Epiz. 13 (3): 905-925.
- [24] Najma DJ, Abiy YZ, Ermias AV, Beatrice TO, Ramni JL. (2015). Traditional Ethnoveterinary medicine in East Africa: a manual on the use of medicinal plants. The World Agro forestry Centre (ICRAF), Nairobi, Kenya. 88-218.
- [25] Offiah NV, Makama S, Elisha IL, Makoshi MS, Gotep JG, Dawurung CJ, Oladipo OO, Lohlum AS, Shamaki D. (2011). Ethnobotanical survey of medicinal plants used in the treatment of animal diarrhoea in Plateau State, Nigeria. BMC Veterinary Research. 7(36): 1-9.
- [26] Okoli IC, Okoli CG, Ebere CS. (2002). Indigenous livestock production paradigms revisited: Survey of plants of ethnoveterinary importance in Southeastern Nigeria. Tropical Ecology. 43(2): 257-263.
- [27] Padulosi S, Leaman D, Quek P. (2002) Challenges and opportunities in enhancing the conservation and use of medicinal and aromatic plants. J Herbs Spices Med Plants. 9: 243-267.
- [28] Panda T, Mishra N, Pradhan BK, Rout SD, Mishra RK and Mohanty RB. (2017). Plants used in traditional healthcare of livestock: a case study from Kendrapara district, Odisha, India. Journal of Medicinal Plant Studies. 5(4): 175-182.
- [29] Phondani PC, Maikhuri RK and Kala CP. (2010). Ethnoveterinary uses of medicinal plants among traditional herbal healers in Alaknanda Catchment of Uttarakhand, India. Afr J Trad Comp Med. 7:195–206.
- [30] Saganuwan AS. (2009). Tropical plants with antihypertensive, antiasthmatic and antidiabetic value. J Herb Spices Med Plants. 15:24-44.
- [31] Saganuwan AS, Gulumbe ML. (2007). Screening of Vernonia amygdalina for in-vitro antimicrobial activities and phytochemical constituents. J Med Pharmaceutic Sci. 3(4):32-37.
- [32] Saganuwan AS, Uko OJ. (2005). Nutritive potential of neem seed kernel in cockerels. J Sci Indus Stud. 3(1):26-29.
- [33] Saganuwan AS. (2010). A photo album of some medicinal plants of the Nigerian middle belt. J Herb Spice Med Plants. 16(3):219-292
- [34] Saganuwan AS. (2010). Some medicinal plants of Arabian Peninsula. J Med Plant Res. 4(9):766-788.

- [35] Saganuwan AS. (2017). Ethnoveterinary Values of Nigerian Medicinal Plants: An Overview. *European Journal of Medicinal Plants*. 18(4): 1-35.
- [36] Saikia B, Borthakur SK. (2010). Use of medicinal plants in animal healthcare – a case study from Gophur, Assam. *Indian Journal of Traditional Knowledge*. 9(1): 49 – 51.
- [37] Sharma LD, Bahga HS, Soni BK. (1967). Anthelmintic screening of three indigenous medicinal Plants against *Ascaridia galli* in poultry. *Indian Vet J*. 44(8):665-669.
- [38] Sofowora A. (1993). *Medicinal plants and traditional medicine in Africa*. John Willey and Sons, New York. 289.
- [39] Suroowan S, Javeed F, Ahmad M, Zafar M, Noor JM, Javeed SKA, Mahomoodally FM. (2017). Ethnoveterinary health management practices using medicinal plants in South Asia – a review. *Vet Res Commun*. 41(2): 147-168.
- [40] Toyang N, Wanyama J, Nuwanyakpa M, Django S. (2007). Ethnoveterinary medicine: a practical approach to the treatment of cattle diseases in sub-Saharan Africa. *Agrodok*. 44: 17- 24.
- [41] Uwagie-Ero AE, Shuaibu I, Saviour NO. (2017). An overview of ethnoveterinary medicine in Nigeria. *Trop J Nat Prod Res*. 1(4):153-157.
- [42] WHO (2019). *Global Report on Traditional and Complementary Medicine*. Geneva: World Health Organization.
- [43] Yinegar H, Kelbessa E, Bekele T, Lulekal E. (2007). Ethnoveterinary medicinal plants at Bale Mountains National Park, Ethiopia. *Journal of Ethnopharmacology*. 112: 55-70.