ARID ZONE JOURNAL OF ENGINEERING, TECHNOLOGY & ENVIRONMENT
AZOJETE, September 2019. Vol. 15(3) 725-732
Published by the Faculty of Engineering, University of Maiduguri, Maiduguri, Nigeria.
Print ISSN: 1596-2490, Electronic ISSN: 2545-5818
www.azojete.com.ng

ORIGINAL RESEARCH ARTICLE

AN ASSESSMENT OF SOME OF THE POISONOUS PLANT SPECIES TO ANIMALS FOUND IN DELTA STATE, NIGERIA

A.H. Erhenhi[1] and E.E. Lemy[2]

([1]Department of Botany, Faculty of Science, Delta State University, Abraka, Nigeria
[2]Department of Animal and Environmental Biology, Faculty of Science, Delta State University, Abraka, Nigeria)
** Corresponding author's email address: aherhenhi@delsu.edu.ng*

ARTICLE INFORMATION

Submitted 22 November, 2018
Revised 7 March, 2019
Accepted 10 March, 2019

Keywords:
Assessment
poisonous plants
Phytochemicals
Delta State

ABSTRACT

This study investigated some poisonous plants to animals in three communities viz; Ebor-Orogun in Ughelli North Local Government Area; Kwale in Ndokwa West Local Government Area and Ozoro in Isoko South Local Government Area, all in Delta State, Nigeria. Dried leaves, roots and tubers of Dennettia tripetala, Cola nitida, Dracaena marginata, Cucumis melo, Terminalia catappa, Persea americana, Manihot esculenta, Telfaira occidentalis and Vernonia amygdalina were grounded to coarse powders and 16g of each powder was weighed into a conical flask. Distilled water (120cm3) was added and the content was shaken and kept for 48hours at room temperature. Filtration of the extract was carried out using whatman No1 filter paper and concentrated using vacuum evaporator. Phytochemical analysis was carried out using standard methods. The results revealed that there were nine (9) indigenous plants with poisonous effects to animals as reported by the community dwellers, among the selected plants and these include: D. tripetala, C. nitida, D. marginata and C. melo, T. catappa, P. americana, M. esculenta (tuber), T. occidentalis (root) and V. amygdalina (root). Qualitative analysis showed the presence of alkaloid, anthocyanines, cardiac glycoside, flavonoid, glycoside, phenol, reducing sugar, saponin, saponin, tannin and terpenoid in low, moderate and high level in the plants. The chemical quantification revealed the presence of tannin (26.90%, 22.95%, 27%) in C. melo, D. tripetala and C. nitida, saponin (13%) in N. laewis, cyanogenic glycoside (3.24mg/l, 1.11mg/l) in M. esculenta and V. amygdalina followed by hydrogen cyanide (0.76mg/l, 0.75mg/l, 6.41mg/l) in P. americana, T. catappa and T. occidentalisas the major cause of poisoning in the plants encountered.There is need for evaluation of the effects of these substances on the organs and systems of animals in order to ascertain the actual site of toxicity of these substances.

1.0 Introduction

Animal husbandry is one of the integral agricultural practices in different parts of the world, although subsistent, it provides both food and income to the people. Some of the inhabitants of these communities depend largely on these livestock for survival, hence the immense importance of the animals in their lives. Forage crops may contain compounds that may inadvertently affect animals (Birgit et al., 2006). In countries with higher plant biodiversity, the

number of problematic toxic plants may be many (Welelign and Mekuriaw, 2016). However, land used for grazing contains both native and invasive plants which increase animal exposure to toxic plants with limited characterization (Birgit et al., 2006).

Losses recorded in animals can be heavy if animals graze in field containing toxic and poisonous plants (USDA, 2011). Several plants of varying species and characteristics accumulate toxic substance in different concentrations. Such plants include Amaranthus species, Solanum species and Chenopodium species as reported elsewhere to contain some toxic nitrate at high concentration (Puschner et al., 2006). Prevention of loss from poisonous plants in general is a problem of range and livestock management (Pfister et al., 2002). As these plants form are essential components of animal diets and at moderate grazing rate, they will result to no negative effects. Consumption of these plants at excessive rate due to stress conditions and starvation may lead to poisoning.

Diagnosing a plant poisoning can be extremely difficult. In many cases, clinical signs are nonspecific (such as diarrhea) and post-mortem lesions are not characteristic (Gupta, 2018). Specialized veterinary toxicology laboratories may provide testing for plant toxins, but the assays do not cover the wide variety of plant toxins present in most countries (Gwaltney-Brant, 2016). There has been a major interest in rate of poisoning caused by consumption of plants; this has resulted in restriction in the consumption of certain plants by humans and animals (Assi et al., 2016). This is a major concern to researchers and it is on this basis this study was developed. The objective of this study is therefore to determine the species of plants poisonous to animals in Delta State, Nigeria with a view to evaluating their chemical composition and toxicity to animals.

2. Materials and Methods

2.1 Description of study area

This study was conducted in three communities viz: Ebor-Orogun in Ughelli North Local Government Area; Kwale in Ndokwa West Local Government Area and Ozoro in Isoko South Local Government Area, all of Delta State, Nigeria (Figure 1). Delta State covers a landmass of about 18,050 km^2 of which more than 60% is land. The state lies approximately between longitude 5°00 and 6°45' E. and latitude 5°00 and 6°30' N. It is bounded in the North East, South-East and on the Southern flank by Edo State, Anambra State, Bayelsa State and Bight of Benin respectively. The state is generally low-lying without remarkable hills. It has a wide coastal belt inter-lace with rivulets and streams, which form part of the Niger-Delta. Delta state has a population of approximately 4,098,291 (Federal Republic of Nigeria Gazette, 2007) and an estimated area of 762km^2. The state is ethnically diverse with people and different languages spoken in the state (National Human Development Report, 2018). The whole ethnic groups that comprise the state are administratively grouped into three senatorial districts namely Delta North, Delta South and Delta Central and have respective human population of 1,229,074; 1,293,282 and 1,575,738. The state is made up of twenty-five local Government Areas. Different animals including goat, dogs, sheep, pigs, birds and cattle grazes in the area.

Corresponding author's e-mail address: aherhenhi@delsu.edu.ng

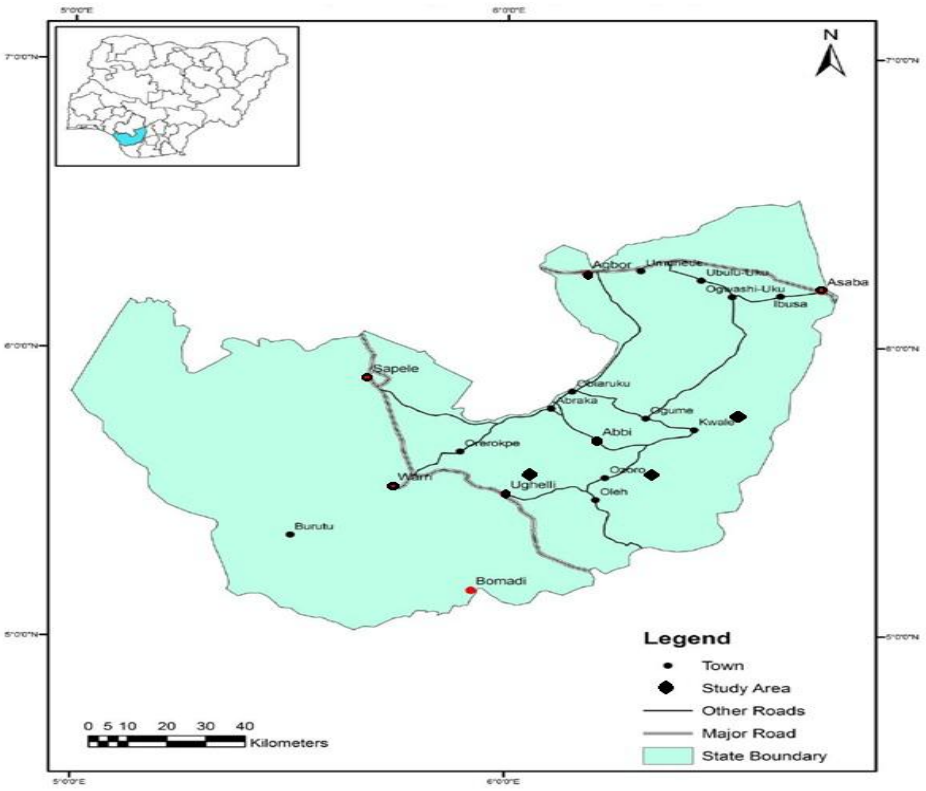

Figure 1: Map of Delta State showing sampled areas
Source: Osayande et al. (2016).

2.2 Collection of Poisonous Plant

Plants with history and records of poisonous substances to animals were sorted within the selected local communities in Delta State. Information on the poisonous nature of the plants was obtained from the locals. All the species of plant were collected from the three different communities. Leaves were collected using knife, stem were collected from the parent plant using cutlass while the root and tubers were collected by uprooting the plant from the soil with the aid of cutlass and hoe and used for analysis of major secondary metabolites.

2.3 Extraction of the Plant Materials

Fresh leaves, roots and tubers of the collected plants were washed carefully in clean running tap water and dried at room temperature. Dried leaves were grounded to coarse powder, and 16g of the powder was weighed into conical flask and distilled water ($120cm^3$) was added and covered with aluminum foil. The content was shaken and kept for 48 h at room temperature. Filtration of the extract was carried out using whatman No1 filter paper and the filtrate was concentrated using vacuum evaporator (Auwal et al., 2012).

2.4 Phytochemical Screening of Plant Extract

Phytochemical screening of the plants samples were carried out using a modified method of Auwal et al. (2012). Tannins was determined by pouring 2.0 cm3 of the extract in a test tube and diluted with 5ml distilled water. A blue black colouration was formed by adding 2 – 3 drops of 5% ferricchloride solution which indicated the presence of tannins. Flavonoids was determined in the samples by adding 2ml of petroleum ether to 0.5g of the plant extract and shaken to remove

Corresponding author's e-mail address: aherhenhi@delsu.edu.ng

the lipid layer. The residue was further dissolved in 20 cm^3 of 80% ethanol and filtered. 5ml of 1% potassium hydroxide was added to 3cm^3 of the filtrate in a test tube and colour change was observed. The presence of dark yellow colouration indicated the presence of flavonoids. Alkaloid was determined by adding 2 -3 drops of Dragendoff's and Mayer's reagents to 10 cm^3 of the aqueous extract in 2 separate test tubes. The presence of orange red precipitate/turbidity with Dragendoff's and white precipitates with Mayer's indicated the presence of alkaloids. Cardiac glycoside was determined as follows. 5 cm^3 of the aqueous extract was mixed with 2 cm^3 of glacial acetic acid containing one drop of ferricchloride ($FeCl_3$) solution. This was followed by the addition of 1 cm^3 concentrated Sulphuric acid. The presence of brown ring at the interface indicated the presence of glycoside. Test for saponins was carried out as follows. 0.5g of grounded plant material was poured into a test tube and 5 cm^3 of water was added and shaken. Saponin was indicated by persistent froth for about 15 min.

2.5 Statistical Analysis

The results obtained from the different analysis were subjected to statistical analysis using Microsoft Office Excel Version 2007 to obtain mean values. The results were presented in simple statistical tables.

3. Results and Discussion

3.1 Identification of Poisonous Plants

Nine (9) poisonous plant species to animals were investigated within local communities in Delta State during the study. The plants include *D. tripetala, C. nitida, D. arginata and C. melo, T. catappa, P. americana, M. esculenta, T. occidentalis and V. amygdalina.*

3.2 Identification of Chemical Constituents

Different phytochemical constituents were identified from the leaves, root and tuber of these plant species and presented in Table 1. The study showed the presence of secondary metabolites such as alkaloid, anthocyanines, cardiac glycoside, flavonoid, glycoside, phenol, reducing sugar, saponin, saponin, tannin and terpenoid to be present at various levels in all the plants recorded. Although, anthocyanines was absent in *D. tripetala, C. nitida, D. marginata, C. melo, P. americana* and *T. catappa*, glycoside was also absent in *M. esculenta, T. occidentalis* and *V. amygdalina.* Similarly, phenol was absent in D. tripetala, C. nitida, D. and marginata, C. while reducing sugar was relatively absent in *C. melo*, *P. Americana, T. catappa, M. esculenta, T. occidentalis* and *V. amygdalina*. The study also showed that terpenoid was absent in T. occidentalis while other phytochemicals were present in all plants at varying degrees (Table 1).

Corresponding author's e-mail address: aherhenhi@delsu.edu.ng

Table 1: Qualitative phytochemical constituents of poisonous plants to animals

Phytochemicals	D. tripetala	C. nitida	D. marginata	C.melo	P. americana	T. catappa	M. esculenta	T. occidentalis	V. amygdalina
Alk aloid	+	+	+	+	+	+	+++	+	+
Anthocyanines	-	-	-	-	-	-	+	++	++
Cardiac glycoside	++	+	+	+	+	-	++	+	+++
Flavonoid	+	+	+	+	+	+	+++	+	++
Glycoside	+	+	+	+	+	+	-	-	-
Phenol	-	-	-	+	+	+	+	+	+
Reducing sugar	-	+	+	-	-	-	-	-	-
Saponin	+	+	+	++	++	+	+	++	++
Steroid	++	+	+	+	+	+	++	+	+
Tannin	+	+	+	+	+	+	+++	+	+
Terpenoid	++	+	+	+	++	+	+	-	+

Key: +: Low, ++: Moderate, +++: High, -: Absent

The chemical quantification revealed the presence of tannin, saponin, cyanogenic glycoside and hydrogen cyanide as the major cause of poisoning in the plants encountered. The result showed that *C. nitida* and *D. tripetala* showed the presence of tannin while N. laewis showed the presence of saponin as the cause of poisoning. Cyanogenic glycoside was extracted from *M. esculenta*, *V. amygdalina* and *T. occidenttalis* roots. *P. americana* and *T. catappa* revealed the presence of hydrogen cyanide while *C. melo* showed the presence of tannin as the cause of poisoning (Table 2).

Table 2: Quantification of poisonous chemicals present in plants

S/N	Plants	Tannin (%)	Saponin (%)	Cyanogenic Glycoside (mg/l)	Hydrogen cyanide (mg/l)
1	*Cucumis melo*	26.90	0.0	0.0	0.0
2	*Persea Americana*	0.0	0.0	0.0	0.76
3	*Terminalia catappa*	0.0	0.0	0.0	0.75
4	*Cola nitida*	27	0.0	0.0	0.0
5	*Newbouldialaewis*	0.0	13	0.0	0.0
6	*Dennettia tripetala*	22.95	0.0	0.0	0.0
7	*Manihot esculenta Grantz.*	0.0	0.0	3.24	0.0
8	*Telfairia occidentalis Hook. F.*	0.0	0.0	0.0	6.41
9	*Vernonia amyygdalina Del.*	0.0	0.0	1.11	0.0

Corresponding author's e-mail address: aherhenhi@delsu.edu.ng

3.3 Discussion

The result of the study revealed the presence of different phytochemicals in plants poisonous to animals in different parts of Delta State. This includes tannin, saponin, flavonoid, steroid, terpenoid, cardiac glycoside, alkaloid, glycoside and reducing sugar in different concentration. Similar phytochemical has previously been reported by several authors including Auwal et al. (2012) and Okwu (2004). The result showed that the phytochemical qualification varies from plant. Phytochemical variation in plant has been reported to alter the consumption pattern of plants by herbivores (Andrea et al., 2016). The study also reported hydrogen cyanide, a toxic substance to animal which occurs via exposure to cyanide ions (CN^-) when dissolved in water (Soto-blanco et al., 2008). However, the toxic effects of these plants to animals may be due to the presence of multiple phytochemicals in the plants (Auwal et al., 2012). Several factors are responsible for the toxic nature of plants to animals. The result of this study showed that C. melo posse's toxic compounds which are responsible for its detrimental nature to animals. However, the presence of lectins in C. melo has been identified to be detrimental to numerous insect andpests of crop plants (Raman et al., 2012). The majority of these plant lectins are present in seeds, roots, stems and leaves. These lectins act as chemical messengers that could bind to the sugars of cells in the gut and the blood cells, initiating an inflammatory response (de Melo et al., 2011). At high intakes, lectins can seriously threaten the growth and health of consuming individuals (Sze and Tzi, 2011).

Toxicity of P. americana has been reported to be poisonous to different animals by Eduardo et al. (2013). However, this plant has also been reported in this study to be poisonous to animals due to the presence of cyanogenic compounds. M. esculenta recorded to be poisonous in the study has previous been reported by Cereda and Mattos (1996) to be toxic to animals due to the presence cyanogenic glucosides such as linamarin and lotaustralinin cassava plant. Toxicity can result from adverse cellular, biochemical, or macromolecular changes. Examples are: cell replacement, such as fibrosis, damage to an enzyme system, disruption of protein synthesis, production of reactive chemicals in cells and DNA damage (Xinsheng and Jose, 2012). Some xenobiotics may also act indirectly by modification of an essential biochemical function, interference with nutrition and alteration of a physiological mechanism (Cutler, 2010).

4. Conclusion

The present study reported phytochemical composition and quantification of selected plants with toxic effects on animals. The result showed that the phytochemical contents of the plants varied both in qualification and quantification. The presence of certain phytochemical content such as cyanogenic glycoside and hydrogen cyanide in the plants is of major concern as these substances are toxic and could be the cause of death to animals. There is need for evaluation of the effects of these substances on the organs and systems of animals in order to ascertain the actual site of toxicity of these substances.

References

Andrea, EG., Christopher, SJ., Matthew, LF., Thomas, LP., Chris, CN., Joshua, PJ., Joseph, SW., Thomas, RW., Lora, AR., Angela, MS., Michael, DL., Colin, RM., Wilmer, S., Luis, AS., Craig, DD., Jim, SM., Eric, JT., Santiago, V., Lee, AD. 2016. Intraspecific phytochemical variation shapes community and population structure for specialist caterpillars. New Phytologist 212(1):208-219.

Corresponding author's e-mail address: aherhenhi@delsu.edu.ng

Assi, MA., Hezmee, MNM., Haron, AW., Sabri, MYM., Rajion, MA. 2016. The detrimental effects of lead on human and animal health. Veterinary World 9(6):660-671.

Auwal, SM., Atiku, MK., Wudil, AM. and Sule, MS. 2012. Phytochemical composition and acute toxicity evaluation of aqueous root bark extract of Securidaca longipedunculata (LINN). Bayero Journal of Pure and Applied Sciences, 5(2): 67– 72.

Birgit,P., Amy, P. and Leslie, W. 2006. Toxic weeds and their impact on animals. California Animal Health and Food Safety Laboratory System, University of California. P16.

Cereda, MP. and Mattos, MYC. 1996. Laminarin – the toxic compound of cassava. Journal of Venomous Animals and Toxins 2(1):6-12.

Cutler, JC. 2010. Toxicity. In: encyclopedia of earth.http://www.eoearth.org/article/toxicity. Retrieved August 2011.

De Melo, CM., Porto, CS., Melo, JMR., Mendes, CM., Cavalcanti, CC. and Coelho, LC. 2011. Healing activity induced by Cramoll 1,4 lectin in healthy and immune compromised mice. International Journal of Pharmacy 408(1-2):113-119.

Eduardo, PC., Moises, MV., Jose, MF. and Socorro, VR. 2013. Acute toxicity and genotoxic activity of avocado seed extract (Persea americana Mill., c.v. Hass). The Scientific World Journal 13:1-4.

Federal Republic of Nigeria Official Gazette 2007. Legal Notice on Publication of the Details of the Breakdown of the National and State Provisional Totals 2006 Census.

Gupta, RC 2018. Veterinary Toxicology; Basic and Clinical Principles; third edition. Academic Press. 1238p.

Gwaltney-Brant SM. 2016. Veterinary forensic toxicology. Veterinary Pathology 53(5):1067-1077.

National Human Development Report (2018). Achieving human development in North East Nigeria; towards an understanding of the humanitarian development – peace nexus. Published by United Nations Development Programme. 116p.

Okwu, DE. 2004. Phytochemicals and vitamin content of indigenous spices of South Eastern Nigeria. Journal of Sustainable Agriculture and Environment 6:30-34.

Okwu, DE. 2005. Phytochemicals, Vitamins and Mineral contents of two Nigeria Medicinal plants. International Journal of Molecular Medicine and Advance Science 1(4): 375-381.

Osayande, PE., Orhue, ER., Oneju, AA., Oseghe, DO., Maidoh, FU. and Irhemu, P. 2016. Biophysical properties of selected Areas of Delta State and their suitability assessment for coconut, raphia and oil palms cultivation. Journal of Environment and Earth Science 6(10):32-38.

Pfister, JA., Provenza, FD., Panter, KE., Stegelmeier, BL. and Launchbaugh, KL.2002. Risk management to reduce livestock losses from toxic plants. Journal of Range Management 55:291-300.

Puschner, B., Woods, L. and Peters, A. 2006. Toxic weeds and their impact on animals. In: Proceedings of the Western Alfalfa and Forage Conference, Sponsored by the Cooperative Extension Services, Plant Sciences Department, University of California. 6p.

Raman, BV.,Sravani, B., Rekha, PP., Lalitha, KVN. and Rao, BN. 2012. effect of plant lectins on human blood group antigens with special focus on plant foods and juices. International Journal of Research in Ayurveda and Pharmacy 3(2):255-263.

Corresponding author's e-mail address: aherhenhi@delsu.edu.ng

Soto-Blanco, B.,Stegelmeier, B.L. and Pfister, JA. 2008. Comparative effects of prolonged administration of cyanide, thiocyanate and chokecherry (Prunus virginiana) to goats. Journal of Applied Toxicology 28 (3):356–63.

Sze, KL. and Tzi, BNG. 2011. Lectins: Production and practical applications. Applied Microbiology and Biotechnology 89:45-55.

United States Department of Agriculture 2011. Plants poisonous to livestock in the Western States. Agricultural Research Service, Agricultural Information Bulletin Number 415. 120p.

Walelign, B. and Mekuriaw, E. 2016. Major Toxic Plants and Their Effect on Livestock: A Review. Advances in Life Science and Technology 45:1-12

Woods LW, Filigenzi MS, Booth MC 2004. Myocardial degeneration and gastrointestinal disturbance in three horses associated with ingestion of grass hay containing summer Adonis (Adonis aestivalis). Veterinary Pathology 41:215-220.

Xinsheng, G. and Jose, EM. 2012. Molecular mechanisms underlying chemical liver injury. Expert Review in Molecular Medicine 3:14:4.

Corresponding author's e-mail address: aherhenhi@delsu.edu.ng