

Full Length Research Paper

Ethnobotanical survey of medicinal plants commonly used in snakebites in North Western Nigeria

**Ibrahim-Maigandi Hassan^{1,2*}, Aishatu Shehu¹, Abdulkadir Umar Zezi¹,
Mohammed Garba Magaji¹ and Jamilu Ya'u¹**

¹Department of Pharmacology and Therapeutics, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Nigeria.

²Ministry of Health Kebbi State, Nigeria.

Reviewed 9 April, 2020; Accepted 6 July, 2020

The incidence of snake bite in rural West Africa is reportedly high with an 11–17% mortality rate. Nigeria has one third of the cases for snake bite cases in this region. Thus, most tribes in North-western part of Nigeria depend on medicinal plants for snakebites. However, it appears that a gap exists on documentation of these plants especially tropical flora used in the management of snake bite. This led to increase depletion of medicinal plant resources and knowledge of their traditional use. Consequently, this survey provided knowledge and data on medicinal plants use in management of snake bite which will help retard the current rate of extinction and decimation of the medicinal plants in these areas and then provide need to conserve what is left as medicinal plants for posterity sake. The study was carried in three northwestern states of Nigeria namely Sokoto, Kebbi and Zamfara for three months. A semi-structured questionnaire was administered and fourteen respondents made up of herb sellers (7%), traditional medical practitioners (93%). The majority of the respondents were male (100%) and 34% were above 50 years of age. From the study, the data collected shows 25 medicinal plants were in use by different categories of practitioners. Botanical names, local names, family names, plant part (s) use and number of citations were also obtained and documented.

Key words: North-western Nigeria, snakebites, medicinal plants.

INTRODUCTION

Snakebites are common global health problem with complex consequence that is somewhat neglected (Isa et al., 2015). Snakebite is common in many other parts of Africa and the tropics (Gutierrez et al., 2010; Warrell 2010). The incidence of snakebite in rural West Africa is reportedly high with an 11-17% mortality rate (Habib et al., 2001; Habib 2013). Nigeria is one of the countries in West Africa that has one fourth of the cases for snakebites (Nasidi, 2007). Thus, most tribes in

North-western part of Nigeria depend on medicinal plants for snakebites. For thousands of years, medicinal plants have played an important role throughout the world in the treatment and prevention of a variety of diseases. Most people in the world still rely on medicinal plants and most of them have a general knowledge of medicinal plants which are used as first aid remedies, to treat cough, cold, fever, headache, poisonous bites and some simple ailments (Muniappan and Savarimuthu, 2011).

*Corresponding author. E-mail: hassmaigandi@gmail.com; hassibm2000@yahoo.com. Tel: +234-803-2903601.

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](https://creativecommons.org/licenses/by/4.0/)

Ethnobotanical information about plants are usually collected from traditional healers, community leaders, and native people of rural and urban areas. Nigeria is one of the countries in the world with wide range of snake species found in terrestrial, arboreal and aquatic habitats. This is so because of the presence of sparsely populated areas like food storage facilities, unkempt bushes, holes, crevices, and areas where prey is readily or likely to be available for them (Altimari, 1998; McDiarmid et al., 1999; Schmidt et al., 1957). This makes snake envenomation a health problem worldwide, especially in many tropical countries like Nigeria and was consequently declared as a neglected tropical disease by the World Health Organization in the year 2009. It has been estimated that global mortality from snake envenomation is up to 100,000 people per year (Venkata et al., 2015). Snake such as *Naja nigricollis*, *Echis carinatus* and *Bitis arietans* are common in Nigeria and responsible for about 95% snake bite cases (Adzu et al., 2005; Abubakar et al., 2010; Adeiza and Minka, 2013). Poor accessibility and exorbitant cost of antivenoms have disrupted steady supply to snakebite locations where therapy are seriously needed (Bhavya et al., 2014). Another major challenge is the unavailability of a general antidote for either cure and or prevention of snakebites (Yogendra and Sharada, 2014). Medicinal plants, therefore, still remain the mainstay of treatment for snake bites in most developing countries (David, 2010). Medicinal plants have been used as folk medicine for treatment of snakebites for centuries, and the reliance on medicinal plants is primarily due to their effectiveness, cultural preferences, inexpensive nature, non-toxic nature and dependence on neighboring forests (Andrews et al., 2004; Du and Clemetson, 2002; Gupta and Peshin, 2012). Globally, traditional healers are using herbal medicine to cure and prevent snake envenomation (Gupta and Peshin, 2012; Yogendra and Sharada, 2014). Nigeria has many medicinal plants that are yet to be exploited and some are known traditionally to be used in the prevention and treatment of snake bite (Sule, 1999). However, there is paucity of data and no documentation on these plants. Thus, the need to establish an informational database of these medicinal plants used against snake venoms is long overdue. This will serve as a readily available source of information for pharmacological investigation of potential antivenoms and development of phytomedicines and or lead compounds in drug development process. This study therefore attempted to provide information on medicinal plants used in the management of snakebite by traditional practitioners in three northwestern Nigerian States.

MATERIALS AND METHODS

Ethnobotanical survey

An ethnobotanical survey was conducted from January to April, 2017 where relevant information about medicinal plants used in the

management of snakebites in Zamfara, Sokoto and Kebbi States, Nigeria were obtained. Data were collected based on an oral interview with the traditional practitioners using semi structured questionnaire. Only willing respondents were interviewed and documented. Plant specimens were collected along the line, subsequently dried and mounted on card board paper (Burkill, 1985; Sofowora, 1996). It was then taken for identification and authentication in the Herbarium Section of Department of Botany, Ahmadu Bello University, Zaria where specimen voucher numbers were obtained when compared with existing specimen.

Study areas

The survey was carried out in Kebbi, Sokoto and Zamfara State, Nigeria. The occupation and ethnicity of inhabit of these areas formed bases for selection. Kebbi is a state in north-western Nigeria with its capital at Birnin Kebbi. The state was created out of a part of Sokoto State in 1991. Kebbi State is bordered by Sokoto State, Niger State, Zamfara State, Dosso Region in the Republic of Niger and the nation of Benin. It has a total area of 36,800 km². Sokoto State is located in the extreme northwest of Nigeria, near to the confluence of the Sokoto River and the Rima River. It has an estimated population of more than 4.2 million and covers an area of 90,000 square kilometres (35,000 sq mi). Sokoto State is mainly populated by Hausa people with over 80% of people living in the state practicing agriculture. Zamfara is located in northwest Nigeria with an area of 38,418 square kilometres. It is bordered in the North by Niger republic, to the South by Kaduna State, in the east bordered by Katsina State and to the West by Sokoto and Niger States. Sokoto state has a population of 4.1 million with the earliest inhabitants of Zamfara being hunters and giants.

Ethical approval

The objectives of the study were explained to the respondents (traditional medical practitioners and herbalists) and informed consent was obtained from each of them.

Inclusion criteria

Recognized traditional medical practitioners and herbalists who were mentally stable and practice their jobs as at the time of the study were recruited.

Exclusion criteria

Unrecognized traditional medical practitioners and herbalists with no patronage for management of snakebite, mentally ill and not currently practicing their jobs at the time of the study were not enrolled.

Administration of questionnaire

The survey covered a period of one month. Ethno-medicinal information was obtained by consulting traditional medical practitioners and herbalists using semi-structured questionnaire and an oral interview as described by Shehu et al. (2017). The questionnaire was divided into three sections:

Section 1: Demographics such as age, sex, religion, nationality, practice specification, duration of practice and educational background.

Section 2: Professional experience on the management of snakebite was discussed. Questions Such as type of snakebite or wound, frequency of treatment, use of herbal therapy alone or

Table 1. Demographics of respondents.

Parameter	Specification	N(%)
Practice specification	Herbalist	1(7)
	Traditional medical practitioners	13(93)
Sex	Male	14(100)
	Female	0(0)
Age (years)	20-30	2(14)
	31-40	3(21)
	41-50	3(21)
	51 above	5(34)
Religion	Christianity	0(0)
	Islam	12(86)
	Traditional	2(14)
Nationality	Nigerian	14(100)
	Non Nigerian	0(0)

N= number, %= percentage.

otherwise, duration of treatment, accompanied side effects, accompanied verbal instructions, plant part(s) use, availability of plant or plant part(s) and knowledge of treatment were asked.

Section 3: Plants and recipes used in the management of snakebites were inquired with questions like types of herbal preparation, arrangement of plant part(s) ingredient, traditional solvent of choice, traditional extraction methods or method of preparation and method of administration were all considered.

RESULTS

Demography/personal information on respondents

A total of fourteen respondents made up of one herb seller (7%) and traditional medical practitioners 13 (93%) were obtained. Majority of the respondents were male, as observed from demographic information of respondents (Table 1).

Professional experience of the respondents

The survey showed that only herbs are used for the cure of disease by the respondents and also inherited the knowledge of herbs from their ancestors (Table 2).

Medicinal plants commonly used in management of snake bite in North Western Nigeria

The survey also showed that a total of 25 medicinal plants species were in use by different categories of

practitioners. Botanical names, local names, family, plant part(s) and number of citations obtained were presented in Table 3.

Plant forms and parts used in the treatment of snake bite in the survey

Majority of the plant life forms and parts used are trees and root/bark respectively. Other plant forms and their frequencies were reported (Table 4).

DISCUSSION

Snakebite poisoning is one of the unheeded disease in most of the developing countries. African countries are global diversity center for snakes that could be deadly from different families like Vipers, Krait and Cobras (Swaroop and Grab, 1954). Additionally, people living in tropical countries are at high risk of snakebite because of their engagement in agricultural, pastoral and hunting as means of survival. Most medical treatment for the snakebite is the use of antisera, which is costly and inaccessible by the rural patients (Cannon et al., 2008). Thus, medicinal plants are used as essential sources of medicines for humans especially in developing countries (Pankhurst, 1995; Dery and Otsyina, 2000). In this study, an ethnobotanical survey to provide information on the medicinal plants used in the management of snake bite was conducted. Most of the herbal medicines came from trees, many of which also have other uses such as

Table 2. Professional experience of respondents.

Parameter	Specification	N(%)
Years of experience	10-20	3(21)
	21-40	6(43)
	41-60	5(36)
Frequency of treatment	Regular	14(100)
	Irregular	0(0)
Duration of treatment (days)	2-3	6(43)
	7-10	4(28.5)
	14	4(28.5)
Other treatment apart from herb	Divination/oracle/incantation	0(0)
	None	14(100)
Source of knowledge	Ancestral	14(100)
	Training	0(0)
	Divination	0(0)
Availability of plant/plant parts	Available	5(36)
	Scarce	5(36)
	Available on season	4(28)
Accompanied side effects	Nausea/vomiting	16(62)
	Skin removal	2(8)
	Others	4(15)
	None	4(15)
Accompanied verbal instructions	Yes	12(86)
	No	2(14)
Instructions	Stop walking	8(57)
	Don't use other medications	6(43)

N= number of respondents; % percentage of respondent.

providing timber and protection of the environment. They have taxonomic classes which enable their classification with respect to their role in economic development (Ekanem and Udoh, 2009). In the study areas, the use of traditional medicine is widely acceptable and on the increase daily especially for snakebite. This was evidenced from the number of plant reported to be used in management of snakebite. So also, some of the plant species reported used were identified as medicinal plants in some other states across Nigeria (Aiyeloja and Bello, 2006; Kayode, 2008). The species variations recorded in this study were comparable to some of those recorded in a study of medicinal plants used in Katsina State in Northwestern Nigeria (Danjuma and Darda'u, 2013) and those of Biu Local Government area of Borno State, Nigeria (Ampitan, 2013). The local people reported these medicinal plants to be very useful in their communities

and preferred them over orthodox medicines in management of snakebite. Trees were the plants life forms commonly used in the form of leaves, root and bark. This is similar to other studies which reported the use of trees more in traditional medicines, with leaves widely used in most African countries like Nigeria, Uganda, Ethiopia and Mali (Ugbogu and Akinyemi, 2004; Tagola, 2005; Muniappan and Savarimuthu, 2011; Shehu et al., 2017). Some of the medicinal plants were reported to be cited in treating different ailments such as asthma, stomach-ache, headache, diarrhea, whitlow, dysentery, gonorrhoea and cough, among others. Ethnobotanical surveys of medicinal plants used in certain localities support tropical conservations of bioresources (Shehu et al., 2017). It has been known to help in passing down information on traditional medicine from generation to generation through documentation of facts that is

Table 3. Medicinal plants commonly used in the management of snake bite.

S/N	Botanical name	Local/vernacular name	Voucher number	Family name	Part(s) used	Number of citations
1	<i>Xeromphis nilolitica</i>	Chura	2867	Rubiaceae	Bark	2
2	<i>Senna singuena</i>	Loda	6863	Fabaceae	Bark	3
3	<i>Albizia chevalieri</i>	Katsari	900247	Fabaceae	Root	1
4	<i>Piliostigma thonningii</i>	Kalgo	831	Fabaceae	Whole	2
5	<i>Securinega virosa</i>	Tsa	2520	Euphorbiaceae	Root/bark/fruit	5
6	<i>Acacia ataxacantha</i>	Bakin-gumbi, Sarkakiya, duhuwa, hoorahi	698	Fabaceae	Root	1
7	<i>Annona senegalensis</i>	Gwandar-daji	3129	Combretaceae	Leaves/ bark	2
8	<i>Dichrostachys glomerata</i>	Dundu	900236	Fabaceae	Leaves	1
9	<i>Combretum glutinosum</i>	Taramniya/ marke	900191	Combretaceae	Whole	1
10	<i>Combretum lamprocarpon</i>	Tsiriri	900745	Combretaceae	Bark	1
11	<i>Sclerocanya birrea</i>	Danya	6871	Anacardaceae	Leaves	1
12	<i>Securiadaca longepedunculata</i>	Uwar magunguna, farin yaro (H), Ezeogwu (I), Violet tree (E)	1880	Polygalaceae	Bark, leaves	2
13	<i>Senna sieberiana</i>	Malga	1387	Fabaceae	Leaves	2
14	<i>Ziziphus spinachristi</i>	Kurna		Rhamnaceae	Leaves/roots	1
15	<i>Indigofera astragalina</i>	Masahi	2691	Fabaceae	Leaves	1
16	<i>Ziziphus mucuronta</i>	Kurna	454	Rhamnaceae	Leaves/bark	1
17	<i>Senna obtusifolia</i>	Tafasa	1084	Fabaceae	Leaves	1
18	<i>Ziziphus mauritiana</i>	Magarya	7072	Rhamnaceae	Leaves	2
19	<i>Indigofera capitata</i>	Baba (H), Kinoafimice (Y)	1729	Fabaceae	Leaves	1
20	<i>Ficus thonningi</i>	Siriya	7084	Moraceae	Leaves	1
21	<i>Hyptis suaveolans</i>	Bunsurun daji	518	Lamraceae	Leaves	1
22	<i>Crotalaria falcata</i>	Birana	922	Fabaceae	Leaves	2
23	<i>Stereospermum kunthianum</i>	Sansame	900085	Bignoniaceae	Leaves	2
24	<i>Mitrogynas inermis</i>	Gayayya/ Kurukuru	1627	Rubiaceae	Leaves/bark	3
25	<i>Calatropis procera</i>	Tumfafiya	900219	Asclepidaceae	Leaves	2

Table 4. Plant life forms, plant parts used and their frequencies.

Plant life forms	Plant parts used	Frequency
Tree	Root and bark	7
Shrub	Whole	2
Climber	Whole	0
Creeper	Bulbs	0

made available to researchers worldwide (Peter et al., 2018). Documentation also helps reports on herbal information from being lost gradually with every person that dies (Ogbole et al., 2010), which led to slow pace of development of traditional medicine in Nigeria and Africa in general. The rate of depletion of medicinal plant resources is generally high, yet little is known about most of Nigeria's plant species especially tropical floras (Igoli et al., 2005). Survey of this nature assists in providing an informational source for the therapeutic potential of medicinal plants, stimulating the urgent need to retard the current trend of decimation of useful medicinal plants and promote bioconservation.

The traditional practitioners in this study stated that in

most cases, snakebites were first treated locally with traditional medicine at home and transferred to the hospital only when there is no improvement or critical condition. It was reported earlier that initial local treatment of diseases is quite common among the African people (Brown, 1973; Isa et al., 2015). This could be part of the reason why there is diverse modes of preparations and routes of administration of these medicinal plants in the area and in most parts of Africa were traditional medicine is fast gaining grounds. An evidence for use of medicinal plants was reported in this study in which 25 plants were reported useful in snakebites in North-western Nigeria.

The study identified *Securinega virosa* as the most

popular anti-snake bite followed closely by *Senna singuena*. *S. virosa* has been reported to possess several medicinal advantages that were reported pharmacologically. Psychopharmacological potential (Magaji et al., 2014), anti-diabetic properties (Yusuf et al., 2010) and *in vitro* inhibition of glioblastoma multiforme cell survival (Magaji et al., 2015) of *S. virosa* were scientifically validated. The use of *S. singuena* was reported as an alternative or adjuvant therapy for malaria (Hiben et al., 2015). Out of the 25 medicinal plants documented in this survey, only one, *Xerompis nilotica* has been scientifically validated to possess anti-snake bite (Ushanandini et al., 2009). Some of the common recipes, methods of preparation and administration procedure were also documented.

Conclusion

This study has provided information on the usefulness of medicinal plants in management of snake bite in Zamfara, Kebbi and Sokoto State, Nigeria. An informational data for accessing and documenting traditional knowledge of medicinal plants used in management of snake bite was established. Further work is currently ongoing in the laboratory to validate the folkloric claims of these plants.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENT

The support of Mr Kabiru Abdullahi of the Department of Pharmacognosy and Drug Development is highly appreciated.

REFERENCES

- Abubakar BS, Habib ND, Yusuf PO (2010). Randomised controlled double-blind non-inferiority trial of two antivenoms for saw-scaled or carpet viper (*Echis ocellatus*) envenoming in Nigeria. *Echi Tab Study Group. PLoS Neglected Tropical Diseases* 4(7):7-10.
- Adeiza AA, Minka NS (2013). Ecological distribution of snakes and the prevalence of parasitic infestations and bacterial isolates from snakes captured within the guinea savannah zone of Nigeria. (PDF Download Available). Retrieved 12 January 2019, from <https://www.researchgate.net/publication/259366432>
- Adzu B, Abubakar MS, Izebe KS, Akumka DD, Gamaniel KS (2005). Effect of *Annona senegalensis* root bark extracts on *Naja nigricollis* venom in rats. *Journal of Ethnopharmacology* 96(3):507-513.
- Aiyelaja AA, Bello OA (2006). Ethnobotanical potentials of common herbs in Nigeria: A case study of Enugu State. *Educational Research and Review* 1(1):16-22.
- Altimari W (1998). *Venomous Snakes: A Safety Guide for Reptile Keepers. Herpetological Circular* 24: 26-30.
- Ampitan TA (2013). Ethnobotanical survey of medicinal plants in Biu Local Government Area of Borno State, Nigeria. *Comprehensive Journal of Herbs and Medicinal Plants* 2(1):7-11.
- Andrews RK, Gardiner EE, Berndt MC (2004). Snake venom toxins affecting platelet function. *Methods of Molecular Biology* 273:335-348.
- Bhavya J, Vineetha MS, Dhananjaya BL, Sunil S (2014). Antisnake Venom Properties of Medicinal Plants. *International Journal of Pharmacy and Pharmaceutical Sciences* 7(1):21-26.
- Brown JH (1973). *Toxicology and Pharmacology of Venoms from Poisonous Snakes*. Springfield, Illinois: Charles C. Thomas.
- Burkil HM (1985). The useful plants of west tropical Africa, Royal Botanic Gardens, Kew, Richmond. <http://www.nhbs.com/series/theuseful-plants-of-west-tropical-africa>.
- Cannon R, Ruha AM, Kashani J (2008). Acute hypersensitivity reactions associated with administration of crotalidae polyvalent immune Fab antivenom. *Annals of Emergency Medicine* 51(4):407-411.
- Danjuma MN, Darda'u H (2013). An Ethno-survey of Medicinal Trees of Kabobi Village, Northern Katsina, Nigeria. *Academic Research International* 4(3):174-183.
- David AW (2010). Snake bite. *Lancet* 375:77-88.
- Dery BB, Otsyina R (2000). The 10 priority medicinal trees of Shinyanga, Tanzania. *Agroforestry Today* 12(1):9-10.
- Du XY, Clemetson KJ (2002). Snake venom L-amino acid oxidases. *Toxicon: Official Journal of the International Society on Toxinology* 40(6):659-665.
- Ekanem AP, Udoh FV (2009). The diversity of medicinal plants in Nigeria: An overview. *ACS Symposium Series* 1021:135-147.
- Gupta YK, Peshin SS (2012). Do herbal medicines have potential for managing snake bite envenomation? *Toxicology International* 19:89-99.
- Gutierrez JM, Williams D, Fan HW, Warrell DA (2010). Snake bite envenoming from a global perspective: Towards an integrated approach. *Toxicon* 56(7):1223-1235.
- Habib AG (2013). Public health aspects of snakebite care in West Africa: perspectives from Nigeria. *Journal of Venomous Animals and Toxins Including Tropical Diseases* 19:27.
- Habib AG, Gebi UI, Onyemelukwe GC (2001). Snake bite in Nigeria. *African Journal of Medical Sciences* 30:171-178.
- Hiben GM, Sibhat G, Sintayehu B, Gebrezgi HD, Belay S (2015). Evaluation of *Senna singuana* leaf extract as an alternative or adjuvant therapy for malaria. *Journal of Traditional and Complementary Medicine* 9(1).
- Igoli JO, Ogaji OG, Tor-Anyiin TA, Igoli PN (2005). Traditional Medicine Practice amongst the Igede people of Nigeria. Part II. *African Journal of Traditional, Complementary and Alternative Medicine* 2:37-47.
- Isa HM, Ambali SM, Suleiman MM, Abubakar MS, Kawu MU, Shittu M, Yusuf PO, Habibu B (2015). In vitro neutralization of *Naja nigricollis* venom by stem bark extract of *Commiphora africana* A. Rich. (Bursaraceae). *IOSR Journal of Environmental Science, Toxicology and Food Technology* 9(12):100-105.
- Kayode J (2008). Survey of Plant Barks Used in Native Pharmaceutical Extraction. In Yorubaland of Nigeria. *Research Journal of Botany* 3(1):17-22.
- Magaji MG, Yakubu Y, Magaji RA, Musa AM, Yaro AH, Hussaini IM (2014). Psychopharmacological Potentials of Methanol Leaf Extract of *Securinega virosa* Roxb (Ex Willd) Baill. in Mice. *Pakistan Journal of Biological Sciences* 17:855-859.
- Magaji MG, Ya'u J, Musa AM, Anuka JA, Abdu-Aguye I, Hussaini IM (2015). *Securinega virosa* (Euphorbiaceae) root bark extract inhibits glioblastoma multiforme cell survival in vitro. *African Journal of Pharmacy and Pharmacology* 9(27):684-693.
- McDiarmid RW, Campbell JA, Toure T (1999). *Snake Species of the World: A Taxonomic and Geographic Reference, Volume 1. Herpetologists' League*.
- Muniappan A, Savarimuthu I (2011). Ethnobotanical survey of medicinal plants commonly used by Kani tribals in Tirunelveli hills of Western Ghats, India <https://doi.org/10.1016/j.jep.2011.01.029>.
- Nasidi A (2007). Snakebite as a serious Public Health problem for Nigeria and Africa, WHO Consultative Meeting on Rabies and Envenomings: A Neglected Public Health Issue, Geneva, Switzerland.
- Ogbole OO, Gbolade AA, Ajaiyeoba EO (2010). Ethnobotanical survey of plants used in the treatment of inflammatory diseases in Ogun State of Nigeria. *European Journal of Scientific Research* 43(2):

- 183-191.
- Pankhurst R (1995). The history of afforestation and deforestation in Ethiopia prior to world war I. *Northeast African Studies* 2(1):119-133.
- Schmidt KP, Inger RF, Pinney R (1957). *Living reptiles of the world* (P. 287). Garden City, NY: Hanover House.
- Shehu A, Magaji MG, Yau J, Abubakar A (2017). Ethnobotanical survey of medicinal plants used for the management of depression by Hausa tribes of Kaduna State, Nigeria. *Journal of Medicinal Plants Research* 11(36):562-567.
- Sofowora OA (1996). *Medicinal Plants and Traditional Medicine in Africa*. Spectrum Books Limited, Ibadan, pp. 150-153.
- Sule MI (1999). *Phytochemical and Pharmacological Studies of the Leaves of Olax Manni Oliv (Olacaceae)*. A Thesis Submitted to The Postgraduate School, Ahmadu Bello University in Partial Fulfillment of the Requirement for the Degree of Master of Science (Pharmaceutical and Medicinal Chemistry).
- Swaroop S, Grab B (1954). Snakebite mortality in the world, *Bulletin of World Health Organization*. *Bulletin of World Health Organization* 10(1):35-76.
- Tagola D (2005). Ethno pharmacological survey of different uses of medicinal plants from Mali (West Africa) in the region of Doila. *Journal of Ethnobiology and Ethnomedicine* 1(1):1-9.
- Ugbogu OA, Akinyemi OD (2004). Ethnobotany and Conservation of Ribako Strict Natural Reserve in Northern Nigeria. *Journal of Forestry Research and Management* 1(1&2):60- 70.
- Ushanandini S, Nagaraju S, Nayaka SC, Kumar KH, Kemparaju K, Girish KS (2009). The anti-ophidian properties of *Anacardium occidentale* bark extract. *Immunopharmacology and Immunotoxicology* 31(4):607-615.
- Venkata NK, Kameswara RK, Sandeep BV (2015). Medicinal plants with anti-snake venom property. *The Pharmacology Innovation Journal* 4(7):11-15.
- Warrell DA (2010). Snake bite, *Lancet* 375:77-88.
- Yogendra KG, Sharada SP (2014). Snake bite in India: Current scenario of an old problem. *Journal of Clinical Toxicology* 4(1):1-9.
- Yusuf T, Okasha MA, Mohammed MG, Musa Y, Yaro AH, Mohammed ISA, Mohammed A (2010). Anti-diabetic properties of *Securinega virosa* (Euphorbiaceae) leaf extract. *African Journal of Biotechnology* 7(1):022-024.