



Taxonomic diversity of medicinal plants utilized for traditional management of snakebite in southeast, Nigeria: Conservation for sustainability

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Abstract

Snake bite is a major health hazard that leads to high mortality particularly in developing countries, where anti venoms are not available to rural dwellers, leading to the use of green remedies for treatment. Traditional healers, vendors and elderly with practical knowledge of plants with snake bite antidotes were interviewed. Semi structured questionnaires; free listing; markets and field tours in six communities in South-eastern Nigeria were used. Seventeen (17) species belonging to 14 eudicots were taxonomically identified as been utilized in the treatment of snake bite. Species in the Fabaceae and Asteraceae contributed the highest taxa, with the greatest remedies obtained from herbs (10), trees (5) and shrub (2) representing 58.82%, 29.42%, and 11.76%, respectively. Most frequently utilized plant parts were leaves (62.5%), bark (18.75%), seeds (6.25%), and roots (12.5%) with decoction (81.82%) as the most recurrently route of administration. Income extractable from these species ranged from < \$15 per plant part remedy to \$78 for treating a victim. Most of these plants are abundant, indicating accessibility and availability. Four of these species are rare wild multipurpose and locally important species with potential threat of genetic erosion, which could be programmed into *ex-situ* conservation and domestication for sustainability.

Keywords: Curative Plants, Snakebite, Rural Dwellers, Non-Experimental, South–Eastern Nigeria

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1. Introduction

During the first earth summit in Rio de Janeiro, the importance of abundance of natural resource from tropical forests and their several services were advocated. These stemmed out not only from the derivable forest products but also from the potent ethno-botanicals and ethno-medicinal services provided by natural from these forests (Durugbo et al., 2012).

Primary health care services in Nigeria have witnessed several trends of changes in the last few decades in relation to awareness, authenticity and number of human resources. However, these changes have not recorded much success in the remote areas as compared to the metropolis, where facilities and human resources could be correlated and matched. Ogbe et al. (2009) reported that gross inequalities and inadequate access to primary health facilities, have not changed from what they were some decades ago in most part of the country. The WHO (2011), data on African Development Indicators revealed that the ratio of medical doctors to the total population for 2009 – 2010 in Nigeria was 1:1376. Uchendu and Atinmo (2011) in confirming the above facts reported that WHO in its performance rating for health system ranked Nigeria 187th of the 200 member states of the WHO nations, where majority of the populace are passing through excruciating pains of malnutrition and poverty accompanied by poor health care system and social infrastructures.

The high cost of modern medication and, their unavailability in remote areas have resulted to the greater number of rural dwellers who turn to traditional medicine for their primary health care delivery (Durugbo et al., 2012). They also adhere to traditional and unconventional medicine because of their accessibility, availability, affordability and inherent trust in their effectiveness over the conventional drugs (ASICUMPON, 2005).

Snake bite has been declared a “Neglected Tropical Disease” by the World Health Organization and this has made it a global health concern for the people in general and the rural communities of the developing countries in particular (Mukherjee, 2012). Statistical data on epidemiology of snake bite, particularly from the developing countries are lacking, due to the improper and unorganized epidemiological investigations in this area. However, information have shown that data on snake bite globally is around 5,400,000 bites per year leading to over 2,500,000 envenoming and around 125,000 death cases annually (Kasturiratne et al., 2008). Snake venoms are badly needed to produce anti venom required to treat potential victims of snake bite particularly for the agrarian rural dwellers who do not have much access to and or not too close to primary health care delivery.

Plant extracts represent an extremely rich source of pharmacologically active compounds and possess more than one biochemical/pharmacological properties. Interaction of such compounds with the toxins/enzymes from snake bite leads to the neutralization/inhibition of their activities (Makhija and Khamar, 2010). The medicinal value of these plants lies in bioactive phytochemical constituents in them such as alkaloids, essential oils, flavonoids, tannins, sponine and phenolic compounds which produce definite physiological actions on the human body (Hostettmann, 2003).

Ezuruike and Prieto (2014) noted that because of the increasing demand for traditional medicine globally, WHO in 2013 re-strategized its goals for the next decade of 2014-2023 to support Member States in harnessing the potentials contributed by traditional medicine to people-centered health care delivery, promoting their safe use, researching on them, integration of the traditional practitioners and their practices into orthodox health care system where appropriate. Kumar et al. (2011) noted that the global market value of pharmaceuticals derived from genetic resources is estimated at US\$ 75 000–150 000 million annually and that the demand for these plant based medicine is growing at the rate of 15 to 25% annually. He further stated that according to the estimate by WHO (2013) the demand for medicinal plants is likely to increase more than US \$5 trillion in 2050.

Ogbe et al. (2009) stated that the more indescribable threat on biodiversity is the erosion of ethno-medicinal knowledge, characteristic of the culturally wealth of diverse ethnic groups in the country. This they opined could be attributed to oral transmission of ethno-medicinal knowledge that is associated with the danger of losing some useful information due to aging and death of the custodians of such knowledge. Urban migration and lack of interest by the younger generation on issues on herbal medicine are not helping matters. It therefore, calls for urgent and appropriate actions on the part of researchers and policy makers to intensify work in this area (Maregesi et al., 2007).

Bearing the above in mind, this research seeks to taxonomically identify those plants used in the treatment of snake bite in some agrarian communities in South-eastern Nigeria with the aim of the possible domestication of those rare multipurpose wild species among them. The specific objectives of this work were to 1) access and document the medicinal plants used in the traditional management of snake bite, 2) compare these with reported species from other works, 3) highlight their multipurpose values and income extractable, and 4) determine the parts used, habits, mode of administration and their conservation status.

2. Materials and methods

2.1. Study site

Nigeria is one of the major countries in West African located in the tropical rain forest zone between latitude 4° and 14°N, and longitude 2°E (Figure 1). The country is bordered by the Gulf of Guinea to the south, Benin on the west and Cameroon on the east. It has a compact land area of 923,768 square kilometers (356,376 square miles) (Ofomata, 1985) with a population of 170,123,740 (US Census Bureau, 2011). Nigeria has a tropical climate with sharp regional variances depending on rainfall governed by the movement of the intertropical discontinuity. Temperatures are high throughout the year, averaging from 25° to 28°C (77° to 82°F). Vegetation also varies dramatically at both the national and local level in relation to climate, soil, elevation, and human impact on the environment. Nigeria's forests host a very high significant proportion of the world's reservoir of diverse genetic resources.

Six local communities in Ebonyi state in South- eastern Nigeria were visited and 10 traditional healers, 20 elderly (men and women) and 20 vendors of medicinal plants each were selected to be the respondent from each of the communities, giving a total of 300 respondents. These communities were Ezza North, Ezza South, Ohaukwu, Ebonyi, Abakaliki and Izzi. These stakeholders having practical knowledge of plants with medicinal values were interviewed during the month of February to August 2013.

2.2. Sample of collection

Semi structured questionnaires were administrated through oral interviews in their local language while those who are filled the questionnaires. The questionnaire contained pertinent questions relating to plants used for the treatment of snake bite including their habit, habitat, occurrence, availability, other uses, sources, their socio-economic values and mode of preparation and administration. Field guided tours were undertaken by accompanying these respondents for collection some of these important plants within their home gardens, markets and from the forest. Digital pictures of plant samples were taken in the field and samples were pressed and deposited in the herbarium of Department of Applied Biology, Ebonyi State University Abakaliki Nigeria. Identification was done using Keay (1965), Hutchinson et al. (1963), Akobundu and Agyakwa (1987), ASICUMPON (2005) and The Angiosperm Phylogeny Group (2009).

2.3. Non experimental validation of the identified plants used for snake bite

The non experimental validation of the identified plant species used for the treatment of snake bite were carried out using a modified version of the method described in Ogbe et al. (2009). This method uses scientific literature search for phytochemical/pharmacological data supporting the medicinal use of these plant species in trado- medical for the treatment of snake bite. Four of these species with multipurpose values and wild were evaluated for possible ex-situ domestication based on best methods for regeneration for growth establishment and development.

2.4. Income extraction validation

The income generated from the extraction of these medicinal plants as they affect the livelihood of these local communities and the traditional healers were evaluated. Various vendors and different actors on medicinal plants used in the treatment snake bite within the local markets participated and accessed the prizes for the medicinal plants. Economic evaluation of the medicinally useful plants of some of the multipurpose plants of the inventoried green remedies were carried out by purchasing various parts of these plants from the local markets, weighing them, and then converting their prices from the local currency to the USA dollar. Then prizes for treating victims were equally inferred.

3. Results

A total of 15 plant species belonging to 8 eudicots families were recorded as been used in treating snake bite in some local communities of Ebonyi State, Nigeria. These species are presented in Tables 1-3.

Table 1. Medicinal plants used for snake bite in some local communities in South –eastern Nigeria

Botanical name	Family name	Common name	Local name
<i>Piliostigma thonnigii</i> (Schum)	Fabaceae	Camel foot	Agada asu
<i>Parkia biglobosa</i> (Jacq)	Fabaceae	African locust bean	Ugba
<i>Senna occidentalis</i>	Fabaceae	Negro Coffee	Oshigbuomma,
<i>Aloe barbadensis</i> (Millt) ClamingMasck	Liliaceae	Aloe vera	Aloe vera
<i>Zingiber officiale</i> L.,	Zingiberaceae	Ginger	Ginger
<i>Uvaria chamae</i> P.Beauv	Annonaceae	Finger root	Nnuenwe
<i>Garcinia kola</i> Heckle	Clusiaceae	Biter Kola	Akuillu
<i>Securidaca longepedunculata</i> Fres.	Polygalaceae	Violet tree	Aguegu
<i>Anthocleista djalonensis</i> A.Chev.	Loganiaceae	Cabbage tree	Pokalapokala
<i>Luffa cyludrinca</i> L	Cucurbitaceae	Sponge Gourds	Cucumber
<i>Euphorbia hirta</i>	Euphorbiaceae	Queensland weed	Ogbu- ani
<i>Paulinia pinnata</i> L	Sapindaceae	Bread and cheese plant	Akueshi
<i>Portulaca oleracea</i> L	Portulacaceae	Purslane	Nchi-okerekwi
<i>Strophanthus hispidus</i>	Apocynaceae	Arrow-Poison	Uta
<i>Allium cepa</i> L	Liliaceae	Onions	Alibasa
<i>Vernonia cinerea</i> Less.	Asteraceae	Iron weed	Eroama
<i>Chromolaena odorata</i> L	Asteraceae	Siam weed	Ogbaruo huru

The tables also show a summary of the plant species used in treating snake venom, their scientific, common and local names, occurrence, status, mode of preparation and administration. These tables also show a summary of the parts used, their seasonality, conservation status and income extractable from them.

Table 2. Plant Parts Utilized and Mode of Preparation/administration of the Anti snake Remedies in some Local Communities in South –eastern Nigeria

Botanical Name	Part Used	Preparation /administration
<i>P. thonnigii</i>	Leaf	Boil leaves and stand for 24 hours drinking. (Decoction)
<i>P. biglobosa</i>	Bark	Grind leaves into powder form and paste (Poultice)
<i>S. occidentalis</i>	Leaves	Grind leaves into powder form and paste (Poultice)
<i>A. barbadensis</i>	Leaf	Drinking the juice extract from the leaves (Decoction)
<i>Z. officiale</i>	Root	Mix with finger root in water and drinking.(Decoction)
<i>U. chamae</i>	Leave	Leaf extract is boiled and taken by victim (Decoction).
<i>G. kola</i>	Seed	Chewing and swallow the juice extract from the seed
<i>S. longepedunculata</i>	Root	Chewing and swallow the juice extract from the root
<i>A. djalonensis</i>	Bark	Boiled bark and the extract are taken (Decoction)
<i>L. cyludrinca</i>	Leaves	Pounding leaves and squeezing out juice extract
<i>E. hirta</i>	Leave	Drinking the juice extract from the leaves (Decoction)
<i>P. pinnata</i>	Leaves	Crush leaves and paste on the site of bite (Poultice)
<i>P. oleracea</i>	Leaves	Drinking the juice extract from the leaves (Decoction)
<i>S. hispidis</i>	Bark	Boil leaves/bark and drink the extract (Decoction)
<i>A. cepa</i>	Leaves	Chew leaves and squeeze same on the site of bite
<i>V. cinerea</i>	Leaves	Leaves are boiled and extract taken (Decoction)
<i>C. odorata</i>	Leaves	Squeeze leaves and paste (Poultice)

The most frequently employed plant part utilized in herbal preparations was leaves (63.5%), bark (17.75%), seeds (6.25%), and roots (12.5%). With regard to the frequency route of administration decoction was the most popular having (81.82%) while poultice appeared to be the least preferred route of administration (Table 2). The predominant plant form in used were herbs (52.94%) while trees (29.41%) and shrub (17.64%). In terms of the status of these plants recorded in these local communities for the treatment of snake bite, large proportion of plant remedies are found growing wild (76.47%) while few are cultivated (23.53%) (Table 3).

Table 3. Mode of harvest, habit and status of plants used for snake bite in South-eastern Nigeria

Species	Mood of Harvest	Status	Habit	Cultivated/wild
<i>P. thonnigii</i>	Cutting the shoots	Common	Shrub	Wild
<i>P. biglobosa</i>	Debarking& cutting	Rare	Tree	Wild
<i>S. occidentalis</i>	Stem cutting	Common	Herb	Wild
<i>A. barbadensis</i>	Cutting the shoot	Rare/Threatened	Herb	Cultivated
<i>Z. officiale</i>	Uprooting	Rare/Threatened	Herb	Cultivated
<i>U. chamae</i>	Cutting of the shoot	Common	Shrub	Wild
<i>G. kola</i>	Fruit Harvesting	Rare/Threatened	Tree	Cultivated
<i>S. longepedunculata</i>	Debarking	Rare/Threatened	Tree	Wild
<i>A. djalensis</i>	Cutting & debarking	Common	Tree	Wild
<i>L. cylindrica</i>	Cut	Common	Climber	Wild
<i>E. hirta</i>	Uprooting	Common	Herb	Wild
<i>P. pinnata</i>	Uprooting	Rare/Threatened	Shrub	Wild
<i>P. oleracea</i>	Uprooting	Common	Herb	Wild
<i>S. hispidis</i>	Stem cutting	Rare/Threatened	Tree	Wild
<i>A. cepa</i>	Up rooting	Rare	Herb	Cultivated
<i>V. cinerea</i>	Stem cutting	Common	Herb	Wild
<i>C. odorata</i>	Stem cutting	Common	Herb	Wild

Table 4. Domestication Strategy for Rare Species used in treating snake bite in South-eastern Nigeria

Taxa	Domestication Strategy
<i>P. biglobosa</i>	Seedling setting and stem cutting could be achieved in home gardens. Micro propagation of tissue is also possible
<i>G. kola</i>	Seedling and stem cutting could be achieved by embedding seeds in pseudo stems of plantain and then planted in home gardens
<i>S. longepedunculata</i>	Stem cutting in home gardens and micro propagation
<i>P. pinnata</i>	Stem cutting in home gardens

Table 5. Non experimental Validation of the Rare Species of Snake Bite for Phytochemical content based Literature

Taxa	Multiple Uses	Authority
<i>P. biglobosa</i>	Biflavonoids, xanthonenes, benzophenones, benzophenone and flavanones, lupeol, 4-O-methyl-epi-gallocatechin, epi-gallocatechin, epi-catechin 3-O-gallate, Cardiac glycosides, steroids, alkaloids, transferulic acid,	Farombi et al. (2005), Alabi et al. (2005), Kuntal (2009), Tan et al. (2006), Ajaiyeoba et al. (2006)
<i>G. kola</i>	Phenolic, biflavonoids, xanthonenes and benzophenone , kolaviron, kolanone , kolaflavanone and garcinia flavanone, tannins and guttiferin	Iwu (1993), Etkin (1981), Uko et al. (2001)
<i>S. longepedunculata</i>	beta-D-(3,4-disinapoyl) fructofuranosyl-alpha-D-(6-sinapoyl) glucopyranoside, flavonoids, xanthonenes and beta-D-(3-sinapoyl) fructofuranosyl- alpha-D-(6-sinapoyl) glucopyranoside triterpenes, alkaloids, cardiac glycosides, , saponins and tannins	Ndou (2006), Kuntal (2009), Kamba and Hassan, 2010).
<i>P. pinnata</i>	1,1-diphenyl-2-picrylhydrazyl and 2,2'-azinobis-3-ethylbenzothiazoline-6-sulfonic acid radicals, Phenol, flavonoid, and proanthocyanidin	Jimoh et al. (2007).

4. Discussions

Results from this study recorded 17 diverse medicinal plants used in the treatment of snake bite in the agrarian communities of South-eastern, Nigeria. Habit based on classification of these plants used revealed that maximum remedies were obtained from herbs (10) followed by trees (5) and shrub (2) respectively, indicating that more than 58.82%, of the remedies were obtained from herbs followed by tree 29.41%, and shrub 11.76%. This present work is in line with the report by Panghal et al. (2010) who documented 19 species used as traditional medicines for snake bite in Haryana. These arrays of folk knowledge of the people of Ebonyi state reflects the notion by Makhija and Khamar (2010) who noted that the indigenous people in most local communities possess diversity of the wealth of the culture, religious rites, and rich knowledge of traditional medicinal practices which help them to sustain and maintain their primary health care services. In infirmity to the above observation ASICUMPON (2005) reported that tropical species are important sources of medicine because they contain wide arrays of toxic compounds which have evolved to hinder herbivory or predation by preys. These bioactive compounds are often derived from species that have been used as folk remedies for centuries, especially in developing countries where modern drugs are often unavailable or simply too expensive.

4.1. Predominant family of green remedies

Some families of flowering plants were frequently encountered during this research work more than others. These families were Fabaceae and Asteraceae, contributing three and two species each respectively. Species from the Fabaceae used for the treatment of snake bite were *P. thonnigii*, *P. biglobosa* and *S. occidentalis* while *V. cinerea* and *C. odorata* were contributed by Asteraceae. This is in line with the report by Kuntal (2009) who reported that effective herbs for snakebite antidote are relatively non-toxic and have substantially documented their efficacy as antidote for snake bite, among these species are *Aristolochia* species, *Cissus assamica*, *Hemidesmus indicus*, *Parkia biglobosa*, *Securidaca longipedunculata*, *Tamarindus indica*, *Trianosperma tayuya*, *Thea sinensis*, *Withania somnifera*). Majority of these species recorded by Kuntal (2009) are found in the same families recorded from this present work, such as the Fabaceae and Polygalaceae. These plants are common reflection of abundant families of the mosaic of the low land rain forest and savanna ecotype, indicating their accessibility and affordability by all.

4.2. Plant parts utilized in snake bite

Diverse parts of medicinal plants viz., leaves, stem, bark, root, seed, were used as sources of medicine by traditional healers in these local communities of South-eastern Nigeria. Distributional analysis of these plant parts used as antidote for snake bite revealed that leaf (10), stem (3), bark (3), root (2), and seed (1) were usually used. Percentage analysis of these plant parts used were in the following order leaves (62.5%), bark (18.75%), seeds (6.25%), and roots (12.5%). This was in conformity with the report by Kuntal (2009) who reported that leaf extract of four of the ten plants species used for snake bite in India local communities was the most common of all the plant parts. Asuzu and Harvey (2003) affirmed that the stem bark and leave

extract of *Parkia biglobosa* has shown to be effective in the neutralization of venoms of *Naja nigricollis* and *Echis ocellatus* in experimental models in Nigeria more than any other part.

4.3. Mode of preparation and administration

A significant number of the plant remedies used for promoting snake bite management in these agrarian local communities of South-eastern Nigeria were habitually administered in the form of oral decoction of the leaves extracts from such species as *P. biglobosa*, *P. thonnigii*, *L. cyludric*, *E. hirta*, *P. pinnata* and *P. oleracea* (Table 3). Formulations used by local healers for snake bite victims were in form of decoction prepared by boiling the plant materials with water and extracting the solution after standing it for a day or more, then taken by the victim as decoction orally while few are grind and used as paste on the site of bite as in *P. biglobosa*. Alternatively, juice extracted from fresh plant materials e.g. gel of *Aloe vera*, or powder form of dry plant materials can also be use as recorded in *L. cyludrinca* and *P. pinnata*.

Significant number of these decoctions is made from a single plant part like *U. chamae*, *G. kola*, *S. longepedunculata* and *A. djalonensis*. However, combination of two parts of same plant / two or more plants can be used as recorded for *Z. officiale* and *U. chamae* (finger root). This in line with the report by Gupta and Peshin (2012) who reported that Antisnake venom prepared from several different species of plants at the same time (polyvalent), are usually more effective. This is in conformity with the report by (Makhija and Khamar, 2010), who stated that plant extracts represent an extremely rich source of pharmacologically active compounds and possess more than one biochemical/pharmacological property and that interaction of such compounds with the toxins/enzymes of snake bite leads to the neutralization/inhibition of the activities of snake venom.

4.4. Status of plant remedies used as anti snake bite

Majority of these plant remedies recorded for the treatment of snake bite in these local communities in Ebonyi State were found and collected from the wild, where they are prone to various risks of environmental threat and disappearance due to habitat destruction, environmental degradation and anthropogenic activities. These inexpressible threats are capable of erasing the existence of this useful cultural wealth, if no precautionary and purposeful measures are taken to conserve them.

Four of these species are wild multipurpose and locally important species with potentials for pharmaceutical industrial. These rare species could be domesticated and used to improve the livelihoods of these people by providing raw materials for pharmaceutical industrial and at the same time sustaining their primary health care delivery system. This is in line with the report by Ogbe et al. (2009) who noted that Nigeria is well known for its rich biodiversity of medicinal plants, and their traditions of pharmaceutical plant exploitation and use. They further opined that in this twenty first century, the survivals of these plant species are threatened by unsustainable approaches of harvest, environmental degradation, anthropogenic activities and the vicious cycle of climate variability and change. Hence most of these species are becoming

rare and others are endangered. However, domestication of these plants in a sustainable way could lead to their conservation and hence their sustainability.

4.5. Income extractable from green remedies for snake bite

These medicinal plants inventoried in this study as used for anti snake bite remedy are common and abundant and often having multipurpose values. *P. biglobosa* for instance is used as sweeter, a condiment, for furniture construction. This is in agreement with the report by Asase et al. (2005) on its efficacy on the wide claim by the Hausa communities of Northern Nigeria on their use for the treatment of such diseases as malaria, diabetes mellitus and pains while the stem barks is boiled in water and taken as a decoction for the treatment of inflammatory diseases, and infectious diarrhea. *G. kola* is a highly economical important product in many parts of the country, where the seeds are widely eaten in Igbo land as masticant and as kola (Nwosu, 1990), as industrial bittering agent in some Nigerian breweries (Aniche and Uwakwe, 2010), for prevent dental caries (Eyogi et al., 2007) while fruit pulp is used in the treatment of jaundice and nuts are dried, ground and mixed with honey to make a traditional cough mixture (Adebisi, 2002, Esimone et al., 2002). Recorded prices for product from these species ranged from < \$ 16 - \$76, showing that these plant remedies are not only available and affordable to local people for the treatment of snake bite, but have multipurpose values, thereby constituting a source of income generation for their livelihood. Aside from the above income extractable from these species, treating a victim with these remedies earns up to \$78.

4.6. Domestication strategy for the rare species based on their multipurpose values

Numerous claims by the traditional healers, users and empirical data on the potency and use of many of these plants have been scientifically authenticated thus establishing their potency and efficacy especially in the management of some ailments and other socio-economic values. They contain different arrays of bioactive components such as biflavonoids, xanthenes, benzophenones, benzophenone and flavanones validating these claims (Iwu, 1993; Ajaiyeoba et al., 2006; Farombi et al., 2005; Alabi et al., 2005; Kuntal, 2009; Kamba and Hassan, 2010) (Table 5).

P. biglobosa, *S. longepedunculata* and *P. pinnata* are found to exist in the wild where they are exposed to threats which could lead to genetic erosion if they are not protected and conserved. Outcome of this study showed that germination and establishment rates of cuttings indicate that these species could be cultivated in home gardens and in mixed cropping with less competition with the major crops. This is in with the report by Sina and Traoré (2002) who stated that *P. biglobosa* propagation is mainly by seeds through the conventional method. However, reports have shown that seeds can still viable after 8.5 years with a germination rate of 78.5% when kept at 4°C and 60% relative humidity and treated with concentrated (97%) sulphuric acid for 10 minutes to break dormancy, and subsequently immersed in water for 24 hours. Ehiagbonare (2007) affirmed that grafting, cuttings and marcotting of older trees could show good results in the propagation of these species. The above strategies could enhance their conservation and sustainable development.

5. Recommendation

It is interesting identifying with the cultural and religious practices of these local communities in Nigeria and the arrays of plants they used as remedies for snake bite. However, there are many questions which come to mind such as on the clinical data authenticating their use, research results with respect to this herbal dosage of these snake bite remedies. We, therefore recommend more research on these areas and more on their chemical composition with possible pharmacological activities and products.

Moreover, knowledge of this heritage is still so much localized because it is solely in the custodian of the elderly who may answer the call of nature leading to the disappearance of this knowledge. This present generation with their technologically devices need to be aware of the immense heritage of these plant remedies. To do this it is necessary to institutionalize this. We therefore recommend that it should be included in primary to tertiary education curricula and so taught in conventional education system.

6. Conclusion

The use of plant remedies in the treatment of snake bite in local communities of South –eastern Nigeria has been influenced by inadequacy and lack of access to primary health care facilities, and due to its cost effectiveness, accessibility and cultural acceptability. These plants are not just source of livelihood for various drivers of these plant genetic resources but are multipurpose in values. However, most of species used for snake bite are rare and are found growing in the wild where they are prone to environmental degradation if adequate strategies are not put in place for their sustainable conservation. At the same time several factors threaten the continual transfer of this wonderful heritage and wealth of these local communities and encourage their disappearance. Ogbe et al. (2009) stated that the goals of using herbal remedies for the management of primary health care delivery is not only to promote and provided alternative to health care services to rural dwellers, but that it also strengthens their livelihood status and reflects their cultural identity.

Having established the accessibility, availability and affordability of these species to these local communities, it becomes imperative for policy makers to proffer sustainable programme to overcome these challenges militating against the existence of these plant species. These could stem out from creating awareness on their usefulness and the dangers of bad practices which drivers of these medicinal plants may have been using during harvest. Approaches of this nature could encourage them to cultivate more of these rare wild medicinal plants in mixed cropping in their home garden thereby enriching cultural and agro-forestry systems.

Finally, it could be concluded that the above strategies if properly harnessed could contribute to the creation of green jobs for our teeming youths who are jobless.

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