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## **Ethnobotanical Utilization and Conservation of Chewing Sticks Plants Species in Ekiti State, Nigeria**

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**Abstract:** Surveys and direct field observation were carried out to determine the endangered chewing stick species in Ekiti State, Nigeria. The survey involved the use of semi-structured interviews which were conducted with a fairly open framework that allowed for focused, conversational and two-way communication. Also group interviews were conducted in order to determine group consensus on the chewing sticks plant species. The relative abundance of the identified species was determined by the time it would take to physically come across the plant specimen in the study area. Results obtained revealed that a total of 49 plant species belonging to 28 different families were observed to be in use as chewing sticks. Most of these species were indigenous species; previous studies had revealed that these species were essentially rich in various natural products. The relative abundance test revealed that, 33, 51 and 16%, respectively, of the chewing sticks species were presently common, frequent and occasional on the abundance scale used in this study. Most of the species were uncultivated species whose wildlings were usually preserved in the study area and were in high demand in the study area. Other products widely derived from these species in the study area were identified. Thus the endangered species required urgent conservation efforts. Features that could enhance their conservation in the study area were defined.

**Key words:** Ethnobotany, conservation, chewing sticks, Ekiti State, Nigeria

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### **INTRODUCTION**

In the recent times, the importance of ethnobotanical knowledge in the management of natural resources is increasingly being stressed (Berkes *et al.*, 2000). Study by Reyes-Garcia *et al.* (2007) suggested that the conservation of biological diversity can be more successful by finding allies. Previous studies by Alcorn (1993) and Berkes *et al.* (1995) had asserted that the indigenous people were potential allies in the conservation of biological diversity. Research suggests that forest products provide them with nutrition, medicine, construction materials, forage and income (Peters *et al.*, 1989; Godoy and Bawa, 1993). Thus, suggesting a correlation between biological and cultural diversities (Lairal, 2002; Maffi, 2005).

Despite all these, there has been an unprecedented erosion of biological diversity and indigenous knowledge in the recent times. This erosion, according to Cox (2000) and Maffi (2002), represents the irreversible loss of humanity's heritage and diversity.

Chewing sticks constitutes one of the plant medicine derived from the forest, which is widely used for dental care throughout the entire West African region. In Nigeria where deforestation rate is currently unprecedented, there has been little or no efforts made to assess chewing sticks botanicals with a view to determine the endanger species among them and propose strategies that would conserve such. These constitute the aims of this study.

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## MATERIALS AND METHODS

Surveys and direct field observation were carried out as done in the previous research (Lipp, 1989; Kayode *et al.*, 1997) between June 2006 and May 2007. Ekiti State (Fig. 1, 2) was divided into three zones based on the existing political delineation (Kayode, 2004). The zones were Ekiti Central (EC), Ekiti North (EN) and Ekiti South (ES). In each zone, five rural communities that were still relatively far from urban influence were selected. The communities were, (1) Epe, (2) Ipole-Iloro, (3) Ido-Ile, (4) Aba-Igbogun, (5) Araromi-Obu, (6) Eda, (7) Iro-Oke, (8) Aba-Oyo, (9) Ogbese, (10) Omi-Ogun, (11) Igede, (12) Itapaji, (13) Ipere, (14) Ifinsin and (15) Ewu. In each community, twenty respondents were randomly selected and interviewed. The interviews were conducted with a fairly open framework that allowed for focused, conversational and two-way communication (Moinar, 1989).

Also in each community, group interviews were conducted in order to determine group consensus on the chewing sticks plant species. Four groups, each of which consisted of five individuals were interviewed in each community. Key informants made up of health, community development and forestry officials in each zone as well as dental officials of the Ekiti State Ministry of Health were also interviewed to provide secondary information on the use of chewing sticks in the study area.

Voucher specimens of the botanicals identified as sources of chewing sticks by the respondents were collected identified and relevant information on them were documented. The specimen were later treated and deposited at the herbarium of the Department of Plant Science, University of Ado-Ekiti, Ado-Ekiti, Nigeria.

The relative abundance of the identified species in each community was determined by the time it would take to physically come across the plant specimen. Plant specimens that could be sited between 0 min to 1 h were regarded as common (C). Those, which could be seen within 1 to 5 h, were

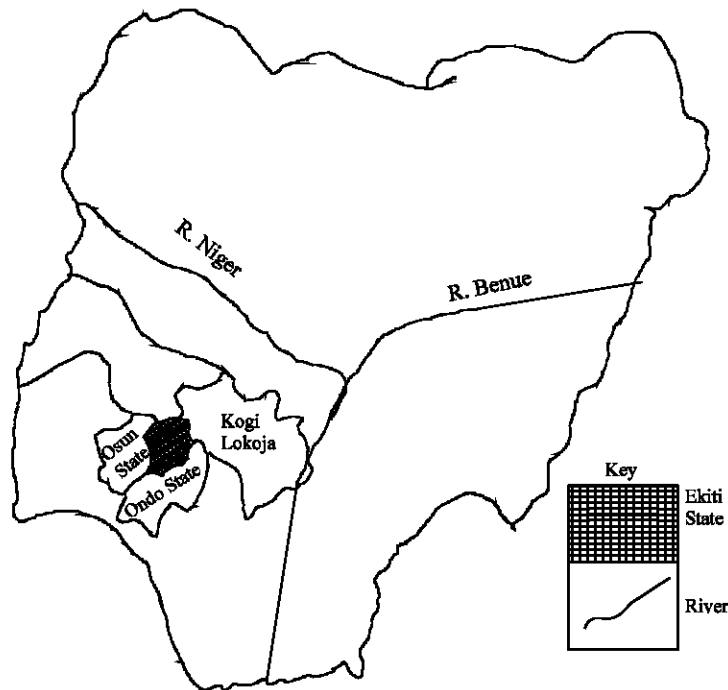


Fig. 1: Map of Nigeria showing Ekiti State of Nigeria

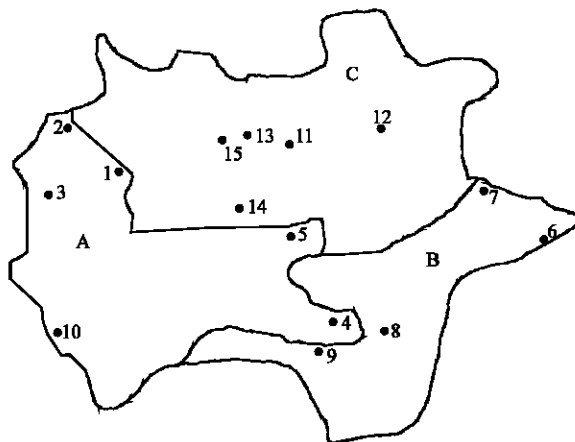


Fig. 2: Map of Ekiti State Showing the study sites used, A: Ekiti Central, B: Ekiti South, C: Ekiti North, (1) Epe, (2) Ipole-iloro, (3) Ido-Ile, (4) Aba-igbogun, (5) Araromi obu, (6) E da, (7) Iro-oke (8) Ipole, (9) Ogbese, (10) Omi-ogun, (11) Igede, (12) Itapaji, (13) Ipere, (14) Ifinsin and (15) Ewu

regarded as frequent (F). Also, those species that would take between 5 to 24 h to be seen were regarded as occasional (O).

Field information was confirmed (Balick and Cox, 1996) and compared with literature (Oliver, 1960; Gbile, 1986; Keay, 1989; Gill, 1992; Kayode, 2006) and the information obtained was analyzed.

## RESULTS AND DISCUSSION

Results obtained from the study area revealed that a total of 49 plant species belonging to 28 different families were observed to be in use as chewing sticks (Table 1). Most of these species were indigenous species, only 13 species (27%) were exotic species, thus supporting the previous assertion of Kayode (2004) that in Ekiti State, Nigeria, preference for botanicals were skewed towards the local species than the exotics. Species identified in this study were noted for their folk dental medicinal values whose knowledge have now constituted parts of the peoples culture that is passed from one generation to another. Previous studies had revealed that these species were essentially rich in various natural products (Table 2).

The relative abundance test (Table 3) revealed that, 33, 51 and 16%, respectively, of the chewing sticks species were presently common, frequent and occasional on the abundance scale used in this study. Among the common species, *C. annum* L., *C. aurantifolia* (Christm and Panzer) Swingle, *M. indica* L. and *T. cacao* L. were cultivated for their fruits which are major sources of income in the study area. *A. indica*, *A. Juss* and *S. siamea* (Lam.) Irwin and Barneby were cultivated to serve as windbreakers and shade providers, *G. sepium* (Jacq.) Kunth ex Walp was planted to provide yam stakes and fodder, *J. curcas* L. and *J. gossypifolia* L. were cultivated to serve as boundary plants and erosion control, *V. amygdalina* Delile was cultivated to provide leafy vegetables, *D. erecta* L. as ornamental plant while *A. laxiflora* (Benth.) Pax and K. Hoffm. and *T. orientalis* (L.) Blume as well as *O. gratissimum* L. though not cultivated but were preserved as sources of timber and medicinal leafy vegetables, respectively.

Table 1: List of chewing sticks botanicals in Ekiti State, Nigeria

Local name	Botanical name	Family	Part used
Adodo yelo	<i>Duranta erecta</i> L.	Verbenaceae	Stem
Afefe	<i>Trema orientalis</i> (L.) Blume	Ulmaceae	Stem
Agunmaniyé	<i>Gliricidia sepium</i> (Jacq.) Kunth ex Walp	Papilionaceae	Stem
Ahuun	<i>Alstonia boonei</i> De Wild	Apocynaceae	Stem
Ajekobale	<i>Croton zambesicus</i> Mull. Arg	Euphorbiaceae	Stem
Akomu	<i>Pycnanthus angolensis</i> (Welw.) Warb.	Myristicaceae	Stem
Alioferá	<i>Aloe vera</i> (L.) Burm. f.	Asphodelaceae	Stem
Arasa	<i>Bridelia micrantha</i> (Hochst.) Baill.	Euphorbiaceae	Stem
Arumu	<i>Cynometra vogelii</i> Hook. f.	Caesalpiniaceae	Stem
Arunje	<i>Harungana madagascariensis</i> Lam ex Poir.	Clusiaceae	Stem
Ata	<i>Capsicum annuum</i> L.	Solanaceae	Stem
Atampara	<i>Phaulopsis imbricata</i> (Forssk.) Sweet	Acanthaceae	Stem
Atori	<i>Glyhaea brevis</i> (Spring) Monach.	Tiliaceae	Stem
Ayin	<i>Anogeissus leiocarpus</i> (DC.) Guill. and Perr.	Combretaceae	Stem
Dongoyaro	<i>Azadirachta indica</i> A. Juss	Meliaceae	Stem
Efirin	<i>Ocimum gratissimum</i> L.	Asteraceae	Stem
Eguneja	<i>Diospyros monbuteensis</i> Gurke	Ebenaceae	Stem
Eesin	<i>Alchornea cordifolia</i> (Schumach. and Thonn.) Mull. Arg.	Euphorbiaceae	Stem
Ewuro	<i>Vernonia amygdalina</i> Delile	Asteraceae	Stem/roots
Ogege	<i>Jatropha multifida</i> L.	Euphorbiaceae	Stem
Guafa	<i>Psidium guajava</i> L.	Malvaceae	Stem
Hibisicosi	<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Stem
Ifon	<i>Olex subscorpioidea</i> Oliv.	Oleaceae	Stem
Isin eye	<i>Blighia sapida</i> K.D. Koenig	Sapindaceae	Stem
Iseketu	<i>Sida acuta</i> Burm. f.	Malvaceae	Stem
Ito	<i>Milletia thonningii</i> (Schmach. and Thonn.) Baker	Papilionaceae	Stem
Iya/pepe	<i>Alchornea laxiflora</i> (Benth.) Pax. and K. Hoffm.	Euphorbiaceae	Stem
Iyeree	<i>Zanthoxylum xanthoxyoides</i> (Lam.) Zepern. and Timber	Rutaceae	Stem/root
Kaju	<i>Anacardium occidentale</i> L.	Anacardiaceae	Stem
Kasia	<i>Senna siamea</i> (Lam.) Irwin and Barneby	Caesalpiniaceae	Stem
Koko	<i>Theobroma cacao</i> L.	Sterculiaceae	Root
Lapalapa funfun	<i>Jatropha curcas</i> L.	Euphorbiaceae	Stem
Lapalapa pupa	<i>Jatropha gossypifolia</i> L.	Euphorbiaceae	Stem
Mangoro	<i>Mangifera indica</i> L.	Anacardiaceae	Stem
Ogan	<i>Combretum racemosum</i> P. Beauv.	Combretaceae	Stem
Ogbase	<i>Sarcocephalus latifolius</i> (Sm.) E.A. Bruce	Rubiaceae	Stem
Okuta	<i>Garcinia mannii</i> Oliv.	Clusiaceae	Stem
Orogbo	<i>Garcinia kola</i> Heckel	Clusiaceae	Stem
Orombo lemonu	<i>Citrus aurantifolia</i> (Christm. and Panzer) Swingle	Rutaceae	Stem
Orogoro	<i>Mallotus oppositifolius</i> (Geiseler). Mull. Arg.	Euphorbiaceae	Stem
Otomporo	<i>Sida corymbosa</i> R. E. Fr.	Sterculiaceae	Stem
Otupe	<i>Carpolobia lutea</i> G. Don	Polygalaceae	Stem
Pako-Ijebu	<i>Massularia acuminata</i> (G. Don.) Bullock	Rubiaceae	Stem
Piaa	<i>Persea gratissima</i> Gaertn.	Lawraceae	Stem
Udi	<i>Terminalia schimperiana</i> Hochst.	Combretaceae	Stem
Uoo	<i>Buchholziya coriacea</i> Engl.	Capparaceae	Stem
Ule	<i>Calliandra portoricensis</i> (Jacq.) Benth	Mimosaceae	Stem
Ura	<i>Bridelia ferruginea</i> Benth.	Euphorbiaceae	Stem
Ure	<i>Clerodendrum buchholzii</i> Gurke	Verbenaceae	Stem

Also among the frequently occurring species, *A. occidentale* L., *B. sapida* K.D. Koenig, *P. guajava* L. and *P. gratissima* Gaertn. were cultivated for their fruits. *A. vera* (L.) Burm. F., *H. rosa-sinensis* L. were cultivated for medicinal and ornamental respectively while *J. multifida* L. was cultivated as boundary plant and for the control of erosion. Other plant species in the frequent categories were not cultivated but their wildlings were usually preserved in the study area.

Table 2: Folk-medicinal value and chemical compositions of the chewing sticks plant species identified in Ekiti State, Nigeria

Botanical name	Folk-medicinal value	Chemical composition
<i>Alchornea cordifolia</i>	Healing of teeth ache and mouth wound	Inulin, tannins, alchormin, alkaloid
<i>Alchornea laxiflora</i>	Posses antimicrobial agents	Tannins,
<i>Aloe vera</i>	Healing of cough and diabetes	Antraquinone, glycosides, aloin, resin
<i>Alstonia boonei</i>	Curing of fever, asthma, rheumatic pains, dizziness	Alkaloids, echitamine, inulin, echitamidine, tannins and saponins
<i>Anacardium occidentale</i>	Curing of tooth ache, sore gums and cough	Tannins, sitosterin, phenols, anacardic acid, cardol, gallic acid, resorcinal derivatives
<i>Anogeissus leiocarpus</i>	Used for oral hygiene	Tannins, phenolic substances
<i>Azadirachta indica</i>	Teeth and gum maintainance, curing of fever	Quercetin-3-rhamnoside, aurcetin-3-rhamnoside, quercetin-3-rutinoside, nimbin
<i>Blighia sapida</i>	Curing of mouth wounds	Saponin, hypoglycin, tannins, steroidal, alkaloids
<i>Bridelia ferruginea</i>	Healing of mouth wounds	Tannins
<i>Bridelia micrantha</i>	Curing of headache	Tannins
<i>Buchholzia coriacea</i>	Used as anti-fungal and anti-bacteria agents	Hupeol and Sitosterol
<i>Calliandra portoricensis</i>	Curing of headache, gonorrhea, lumbago, possess analgesic substances	Anticonvulsant agents
<i>Capsicum annuum</i>	Curing of fever, cold and dysentery, act as stimulant	Capsaicin oil, ascorbic acid
<i>Carpolobia lutea</i>	Curing of stomach ache, used for oral hygiene	Tannins, saponins, flavonoids, cardiac glycosides, anthraquinones
<i>Citrus aurantifolia</i>	Used for oral hygiene	Essential oils
<i>Clerodendrum buchholzi</i>	Curing of fever	Sterols, glucosides, flavonoids, chiretin, opheliac acids, tannins, hydroquinone, diiterpene, uncinatone
<i>Combretum racemosum</i>	Curing of fever and cough	Flavonic heterosides, gum
<i>Croton zambesicus</i>	Curing of malaria	Crotonic acid, saponins
<i>Cynometra vogellii</i>	Used for oral hygiene	Tannins, saponins
<i>Diospyros monbuttensis</i>	Used as anti-fungal and anti-bacteria agents	Tannins, saponins, alkaloids
<i>Duranta erecta</i>	Used for oral hygiene	Alkaloids
<i>Garcinia kola</i>	Curing of cough, tooth ache fever and diabetes	Kolaviron, flavonoids, saponins, ametoflavone, resin
<i>Garcinia mannii</i>	Curing of cough	Alkaloids
<i>Gliricidia sepium</i>	Clearing microbes in mouth	Gliricidin-6A, Gliiricudol-9A, Afronmosin, formononctin Medicurpin, 7,4'-dihydroxy-3'-methypxyiso-flavin 2'-0-methulsepiol
<i>Glyhaea brevis</i>	Curing of fever	Tannins, alkaloids
<i>Hibiscus rosa-sinensis</i>	Curing of cough	Tannins, alkaloids
<i>Harunganamada-gascariensis</i>	Curing of fever, cough, dysentery, asthma, jaundice, diahhoea, sore throat	Alkaloids, tannins, gum
<i>Jatropha curcas</i>	Curing of gum bleeding	Tetramethyl pyrazine, fixed oil, resin, cursin, saponins, inulin, tannins
<i>Jatropha gossypifolia</i>	Healing of mouth cancer	Tetramethyl pyrazine, curcin, jatrophone
<i>Jatropha multifida</i>	Healing of mouth wounds, mouth microbial infections	Curcin, hell oil, pin neon oil, oleum, ricini, majoris, crotonoieic acid, alkaloids, glycoside
<i>Mallotus oppositifolius</i>	Healing of mouth cancer	Rottlerin
<i>Mangifera indica</i>	Curing of malaria, sore gum	Tannins, resins, volatile oil, cyanogenic, glycosides, Methylsalicylate, quereelin
<i>Massularia acuminata</i>	Used for oral hygiene, curing of cough and lumbago	Tannins

Table 2: Continued

Botanical name	Folk-medicinal value	Chemical composition
<i>Milletia thomningii</i>	Curing of fever and sore throat	Tannins, saponins
<i>Ocimum gratissimum</i>	Curing of cough, cold Fever, chest pain, diarrhea	Terpenoids, eugenol thymol. saponins, alkaloids
<i>Olex subscorpoidea</i>	Curing of tooth ache	Saponins
<i>Persea gratissima</i>	Curing of hypertension	Tannins
<i>Phaulopsis imbricata</i>	Used for mouth hygiene	Alkaloids, saponins, tannins
<i>Psidium guajava</i>	Curing of stomach ache, cough	Tannins, resins, essential oil, quercetin, eugenol
<i>Pycnanthus angolensis</i>	Clearing of white tongue	Alkaloids, tannins
<i>Sarcocephalus latifolius</i>	Curing of malaria fever, for oral hygiene, has antibacterial agents	Tannins
<i>Senna siamea</i>	Curing of fever	Tannins
<i>Sida acuta</i>	Used for oral hygiene	Tannins, saponins, postaglardin
<i>Sida corymbosa</i>	Used for oral hygiene	Alkaloids, tannins
<i>Terminalia schimperiana</i>	Curing of sickle cell anemia,	Alkaloids, tannins
<i>Theobroma cacao</i>	Acts as stimulant	Alkaloids, steroid, sitosterol, stigmasterol, tannins
<i>Trema orientalis</i>	Provides remedy for fever, black tongue, cough, bronchitis, dysentery	Saponins, tannins, inulin, alkaloids
<i>Vernonia amygdalina</i>	Curing of cough, diabetes	Vernodalin, vernomydin, saponin
<i>Zanthoxylum xanthoxyloides</i>	Curing of tooth ache sickle cell anemia	Alkaloids, benzoic acid, vanillia acid, inulin, saponnin

Table 3: Relative abundance of chewing sticks plant species in the study area

Abundance	Plant species
Common	<i>A. laflora</i> , <i>A. indica</i> , <i>C. annum</i> , <i>C. aurantifolia</i> , <i>D. monbuttensis</i> , <i>G. sepium</i> , <i>D. erecta</i> , <i>J. curcas</i> , <i>J. gossypifolia</i> , <i>M. indica</i> , <i>O. gratissimum</i> , <i>S. acuta</i> , <i>S. siamea</i> , <i>T. cacao</i> , <i>T. orientalis</i> , <i>V. amygdalina</i>
Frequent	<i>A. cordifolia</i> , <i>A. occidentale</i> , <i>A. vera</i> , <i>B. ferruginea</i> , <i>B. micrantha</i> , <i>B. sapida</i> , <i>C. buchholzii</i> , <i>C. lutea</i> , <i>C. racemosum</i> , <i>C. vogellii</i> , <i>G. brevis</i> , <i>G. kola</i> , <i>G. mannii</i> , <i>H. rosa-sinensis</i> , <i>J. multifida</i> , <i>M. oppositifolius</i> , <i>M. thomningii</i> , <i>O. subscorpoidea</i> , <i>P. angolensis</i> , <i>P. gratissima</i> , <i>P. guajava</i> , <i>P. imbricate</i> , <i>S. corymbosa</i> , <i>S. latifolius</i> , <i>T. schimperiana</i>
Occasional	<i>A. boonei</i> , <i>A. leiocarpus</i> , <i>B. coriacea</i> , <i>C. portoricensis</i> , <i>C. zambesicus</i> , <i>H. madagascariensis</i> , <i>M. acuminata</i> , <i>Z. xanthoxyloides</i>

Table 4: Chewing sticks plant species perceived to require conservation in the study area

Plant species	Conservation status and description in the study area
<i>A. boonei</i>	It is an indigenous species that is not cultivated in the study area, wildlings are however preserved, leaves, roots and stems bark are used for medicine, use as a major source of timber and fuel wood
<i>A. leiocarpus</i>	It is an indigenous species that is not cultivated in the study area, wildlings are however preserved, stems bark and seeds are used for medicine, use as a major source of fuel wood
<i>B. coriacea</i>	It is an indigenous species that is not cultivated in the study area, wildlings are however preserved, use as a major source of fuel wood
<i>C. portoricensis</i>	It is an introduced species that is not cultivated in the study area, wildlings are however preserved, leaves and roots are used for medicine, use as a major source fuel wood
<i>C. zambesicus</i>	It is an indigenous species that is not cultivated in the study area, wildlings are however preserved, all parts of the plant are used for medicine
<i>H. madagascariensis</i>	It is an indigenous species that is not cultivated in the study area, wildlings are however preserved, all parts of the plant are used for medicine, use as a major source of timber and fuel wood
<i>M. acuminata</i>	It is an indigenous species that is not cultivated in the study area, wildlings are however preserved, leaves, roots and stems bark used for medicine, use as a major source of timber and fuel wood
<i>Z. xanthoxyloides</i>	It is an indigenous species that is not cultivated in the study area, wildlings are however preserved, Its stems and roots are used for medicine

The species occurring occasionally, with the exception of *C. portoricensis* (Jacq.) Benth, were indigenous but uncultivated species (Table 3) whose wildlings were usually preserved in the study area. There is a high demand for these species. Table 4 gives the description of other products widely derived from these species in the study area. Thus these species could be said to be endangered in the study area. They require urgent efforts towards their conservation. Some of the species already possessed features that could enhance their conservation (Table 5-11). However, further research activities are still required to develop deep understanding of the life cycles, pollination and dispersal mechanisms in most of these plants. Shinwari and Khan (2000) had advocated similar strategies in a

Table 5: Perceived conservation features of *A. boonei* in the study area

Features	Description	Implications for conservation of the species in the study area
Ecology	Found in the forest and tolerate wide range of sites	Suitable for cultivation in all parts of the Ekiti State, Nigeria
Reproductive biology	Flowers in October to March, fruits in December to May Seeds dispersed by wind	Seeds are ready for planting at the onset of rains in the study area Wide seeds dissemination, enhancement of the development of numerous wildlings
	Germination takes 15 to 25 days	Enhance early replacement of non-viable seeds
	High germination rate	Seedling demands could be easily attained
Growth management	No pre-treatment required for germination Rapid growth	Enjoy economy of time and labour Enhance early delivery of dividends
Germplasm management	Ready coppicing ability Seeds storable in dry and cool places	Enhance replacement after use Ensure seeds availability when planting is to be done

Table 6: Perceived conservation features of *A. leiocarpus* in the study area

Features	Description	Implications for conservation of the species in the study area
Ecology	Found in the savanna	Suitable for cultivation in the savanna area of the study area
Reproductive Biology	Flowers in July to November, fruits in August to January	Suitable for cultivation at the onset of rain in the study area

Table 7: Perceived conservation features of *B. curiacea* in the study area

Features	Description	Implications for conservation of the species in the study area
Ecology	Found in the forest	Suitable for cultivation in most parts of the study area
Reproductive Biology	Flowers in most seasons	Seeds available at most seasons

Table 8: Perceived conservation features of *C. portoricensis* in the study area

Features	Description	Implications for conservation of the species in the study area
Ecology	Found in the forest	Suitable for cultivation in most parts of the study area
Reproductive Biology	Propagated from seeds	Seeds are available for cultivation at the onset of rains

Table 9: Perceived conservation features of *C. zambesicus* in the study area

Features	Description	Implications for conservation of the species in the study area
Ecology	Found in the savanna and forest margins	Suitable for cultivation in most parts of the study area
Reproductive Biology	Flowers in May to August, fruits in November to March	Seeds are available for planting at onset of the rain



Table 10: Perceived conservation features of *H. madagascariensis* in the study area

Features	Description	Implications for conservation of the species in the study area
Ecology	Found in the forest	Suitable for cultivation in most parts of the study area
Reproductive Biology	Flowers in July to April, fruits in September to April Flowers profusely High germination rate Rapid germination	Seeds are available for planting at the onset of the rain Ensures availability of seeds Seedlings demand could be met Enjoys economy of time and enhances easy replacement of non-viable seeds
No pre-treatment required		

Table 11: Perceived conservation features of *Z. xanthoxyloides* in the study area

Features	Description	Implications for conservation of the species in the study area
Ecology	Found in the forest and savanna	Suitable for cultivation in all parts of the study area
Reproductive Biology	Flowers in January to February May to August, fruits in July to September	Seeds are available for planting during the prevailing rainy season in the study area

study conducted in Islamabad. The maintenance of the original self-perpetuating populations, as previously advocated by Moore (1990) would also serve as a sustainable *in situ* conservation method. The conservation of these chewing sticks plant species especially those identified as being endangered is now desirable. All these strategies would slow down and/or circumvent the present rate of biodiversity loss. Swanson (1992) had previously warned that the loss of biodiversity means the loss of options for all of us and for future generations. The loss of species identified as been endangered in this study should be prevented.

## REFERENCES

- Alcorn, J.B., 1993. Indigenous people and conservation. *Conserv. Biol.*, 7: 424-426.
- Balick, M.J. and P.A. Cox, 1996. *Plant, People and Culture*. Scientific American Library, New York, USA.
- Berkes, F., C. Folke and M. Gadgil, 1995. Traditional Ecological Knowledge Diversity, Resilience and Sustainability. In: *Biodiversity Conservation*, Perrings, C.A. (Ed.). Kluwer Academic Publishers, Dordrecht, Netherlands, pp: 281-299.
- Berkes, F., J. Colding and G. Folke, 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecol. Applied*, 10: 1251-1262.
- Cox, P.A., 2000. Will tribal knowledge survive the millennium? *Science*, 287: 44-45.
- Gbile, Z.O., 1986. Ethnobotany, Taxonomy and Conservation of Medicinal Plants. In: *The State of Medicinal Plants Research in Nigeria*, Sofowora, A. (Ed.). University of Ibadan Press, Ibadan, Nigeria, pp: 13-29.
- Gill, L.S., 1992. Ethnomedicinal Uses of Plants in Nigeria. Uniben Press, Benin-City, Nigeria, pp: 279.
- Godoy, R. and K.S. Bawa, 1993. The economic value and sustainable harvest of plants and animals from the tropical forest: Assumptions, hypothesis and methods. *Econ. Bot.*, 47: 215-219.
- Kayode, J., O.A. Ibitoye and O. Olufayo, 1997. Private participation in taungya agroforestry in Ondo-Ekiti Region: Problems and prospects. *Int. J. Urban and Regional Affairs*, 1 (1): 54-57.
- Kayode, J., 2004. Conservation perception of endangered tree species by rural dwellers of Ekiti State, Nigeria. *J. Sustainable For.*, 19 (4): 1-9.
- Kayode, J., 2006. Conservation of indigenous medicinal botanicals in Ekiti State, Nigeria. *J. Zhejiang Univ. Sci.*, B 7 (9): 713-718.
- Keay, R.W.J., 1989. *Trees of Nigeria*. Clarendons Press, Oxford, pp: 476.

- Lairal, S., 2002. Biodiversity and Traditional Knowledge Equitable Partnership in Practice. Earthscan, London, pp: 504.
- Lipp, F.J., 1989. Methods of Ethno-pharmacological field work. *J. Ethno-Pharmacol.*, 25: 139-150.
- Maffi, L., 2002. Endangered knowledge. *Int. Soc. Sci. J.*, 54: 385-393.
- Maffi, L., 2005. Linguistic, cultural and biological diversity. *Annu. Rev. Anthropol.*, 34: 599-618.
- Moinar, A., 1989. Community Forestry: A Rapid Appraisal. FAO. Rome, pp: 60.
- Moore, H.J., 1990. Editorial. *Impact of Science and Society* No. 158, UNESCO, Paris.
- Oliver, B., 1960. Medicinal Plants in Nigeria. University of Ibadan Press, Ibadan, Nigeria, pp: 139.
- Peters, C., A.H. Gentry and R. Mendeohn, 1989. Valuation of a tropical forest in Peruvian Amazonia. *Nature*, 339: 655-657.
- Reyes-Garcia, V., S. Tanner, T. Huanca, W.R. Leonard and T. McDade, 2007. Ethnobotanical skills and clearance of tropical rainforest for agriculture: A case study in the lowlands of Bolivia. *Ambio*, 36 (5): 406-408.
- Shinwari, M.I. and M.A. Khan, 2000. Folk use of medicinal herbs of Magalla Hills National Park, Islamabad. *J. Ethnopharmacol.*, 69: 45-56.
- Swanson, T.A., 1992. Wildlife and Wildlands, Diversity and Development. In: *Economics for the Wilds*, Swanson, T.M. and E.B. Barbier (Eds.). Earthscan Publications Ltd. London, pp: 1-14.