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Ethnobotanical Survey of Medicinal Plants from the Villages Around Ngel-Nyaki Forest Reserve, Mambila Plateau: A Nigerian Montane Forest Project

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ABSTRACT

An ethnobotanical survey was conducted to document medicinal plants used by traditional medical practitioners (TMPs) around the Ngel-Nyaki Taraba state, Nigeria, for treating various ailments. The study aimed to preserve indigenous knowledge of medicinal plants, their potential in drug development, and maintaining both the ecological integrity and the cultural knowledge of local communities was a central focus of this research. Field trips twice a month (24) between the 1st week of January and to 2nd week of December 2023 were made to the sites. Interviews were conducted with TMPs, herb vendors, farmers, and elders using semi-structured questionnaires and open-ended conversations. The data were analyzed using Microsoft Excel 2016, focusing on frequencies and percentages for socio-demographic details. The ethnobotanical data were further analyzed using the Relative Frequency of Citation (RFC), Fidelity Level (FL), and Factor Informant Consensus (FIC) to assess the significance of plant species in treating various ailments. The study identified 40 medicinal plant species from 25 families, with *Euphorbiaceae* (11.90%) and *Moraceae* (9.52%) being the most common families. The majority of remedies were prepared from bark (46%) and roots (37%), with leaves (9%), fruits (5%), and stems (2%) being used less frequently. The plants were prepared using decoction, concoction, powder, chewing, edible forms, and infusion. A variety of ailments were treated using these plants, showing the breadth of local medicinal knowledge. Herbal medicine remains central to the healthcare practices of local communities around Ngel-Nyaki Taraba state, Nigeria. Protecting the ecological integrity and conserving traditional medicinal knowledge is crucial.

***Keywords*:** Ethnobotany, Medicinal plants, Traditional knowledge, Survey, Conservation

Introduction

The use of medicinal plants to treat and cure diseases is an age-old practice that has developed over time and is increasing globally in recent years. [8, 53, 28] In Africa, greater than 80% of the residents, particularly in rural areas, depend on plants as their primary source of healthcare. [69] This widespread reliance on traditional medicine can be attributed to several factors. Firstly, the therapeutic effectiveness of many plant-based remedies has been well-documented. [67, 7] Secondly, herbal medicine is usually cheaper than synthetic drugs. [19, 28] Additionally, limited access to modern healthcare services in many regions, [50] and the deep-rooted sociocultural acceptance of traditional medicine further contribute to its extensive use. [52, 58, 20, 15] Countless medicinal plants possess efficiency against a wide range of diseases, essentially due to their pharmacological activities associated with their phytochemical constituents. [26] The increased preference for these plant products is driving unsustainable exploitation to satisfy the rising demand, which is negatively impacting the plant's population. [51]

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Particularly those in high demand and whose roots and barks are harvested are vulnerable and exposed to threats of genetic erosion and increased risk of extinction. [55] This makes documentation of the traditional uses, sustainable utilization, as well as conservation essential. [15] One of the main reasons that can interfere with the conservation and sustainable use of medicinal plant species, particularly amid human-induced pressures, is the lack of ecological knowledge, particularly about the diversity, distribution, and abundance of these threatened species. [60, 27, 29] Another limitation is the declining knowledge of traditional medicine, driven by changing lifestyles and practices. This is further compounded by the fact that indigenous knowledge of medicinal plant use is primarily passed down orally and remains poorly documented even today. [25]

At the moment, almost one-third of medicinal plant species could become extinct, with greater losses expected to occur in arid and semi-arid areas due to factors such as climate change, land-use change, unsustainable exploitation, and an increase in global trade in medicinal plants. [47, 45]

It is these facts that prompted this study, as the outlook for the future of medicinal plants and traditional practices appears increasingly uncertain. There is limited information on the tree species and their medicinal uses as practiced by the indigenous communities inhabiting the Ngel-Nyaki Forest Reserve of Taraba state, Nigeria. The lack of proper documentation of this knowledge has led to poor plant conservation practices and inadequate forest preservation. This study aimed to provide evidence of biodiversity of medicinal plants made use of by local inhabitants around Ngel-Nyaki Forest Reserve Taraba state, Nigeria, to document the traditional knowledge of local communities on indigenous plants used for medicinal purposes, and to compile data on traditional treatments against various ailments, including methods of preparation, plant part(s) utilization, and application.

Materials and Methods

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Study Area

The research was conducted around the Ngel-Nyaki Forest Reserve, which is situated on the Mambilla Plateau in North-Eastern Nigeria, covering 46 km^2. It is accessible on foot from Yelwa village, and the altitude ranges from 1,400 m to 1,600 m. It is located at 7°05′N 11°04′E. The reserve contains a stand of rare dry-type Montane to Sub-montane forest, grassland, and fragments.

Figure 1: Map of Ngel Nyaki Forest Reserve and Communities surrounding the reserve

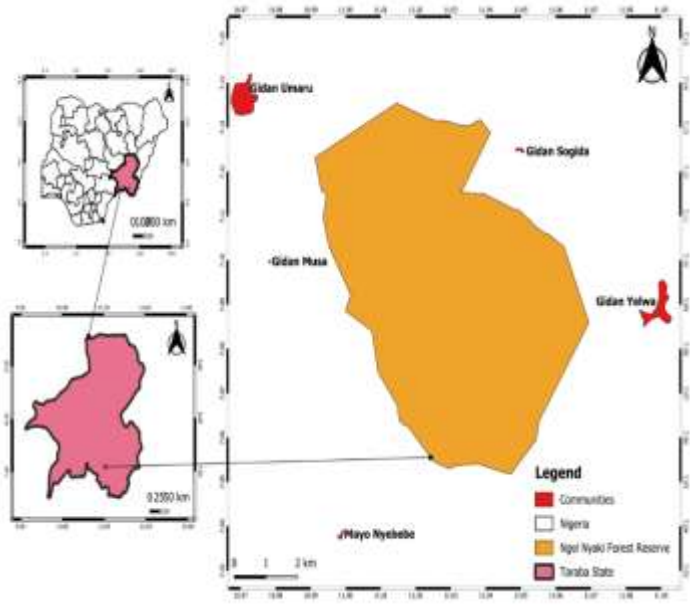

Figure 1: Map of Ngel Nyaki Forest Reserve and Communities surrounding the reserve (Danailu *et al*., 2025)

Ethnobotanical Data Collection

Traditional knowledge of medicinal plants was obtained from participants using semi-structured questionnaires and open-ended conversations. The participants were purposively selected, comprising knowledgeable traditional health practitioners, herb vendors, farmers, and individuals with indigenous knowledge. Though the questionnaire was prepared in the English language, to facilitate efficient communication, Informal discussions with the participants were conducted in the two dominant local languages of the study area, Hausa and Fulfulde. Before each interview, prior informed consent was requested, and throughout the study, the Ethical Standards codes of ethics were respected. After obtaining consent, the respondents were interviewed. The interviews and discussions were carried out in the local languages since the field assistant and some of the researchers can understand and speak the native languages. Data on the plants were gathered in the field according to. [44] A total of 45 participants from five villages (Figure 1) within a 1-10 km distance surrounding the reserve were interviewed individually to maintain confidentiality. This is because the distance from the forest affects how people use forest products. [9] Field trips twice a month from 1st January to 31st December 2023. Participants' demographic information was recorded. Details of the local names of the plants, the plant parts used, diseases treated by these plants, mode of usage, conservation status, and administration route were collected in the field.

Collection and Identification of Medicinal Plants

A field survey along predefined transects was conducted for plant collection. Field collection of plant specimens was carried out using standard botanical methods, [48] together with the TMPs. The coordinates of each collected plant were confirmed using a Geographic Positioning System (GPS) device. The collected specimens were identified at the Nigerian montane forest project (NMFP) Herbarium in Ngel-Nyaki Forest Reserve, Mambilla plateau, Taraba state. Voucher specimens were deposited in the herbarium of the Abubakar Tafafa Balewa University, Bauchi, Nigeria.

Ethics approval and consent to participate

The study adhered to the Ethical Standards of the Institutional Animal Care and Use Committee Unit, Abubakar Tafawa Balewa University, Bauchi, Nigeria, with AUP NO:2022/APV-NR-06. Informed consent was sought and obtained before the study. Anonymity was ensured by not collecting identifying information on individual subjects. Confidentiality was ensured by not delving into the respondent's personal life.

Data Analysis

A descriptive statistical method using frequencies and percentages was used to analyze the socio-demographic data of the respondents, and the data of the ethnobotanical survey were analyzed using the Relative Frequency of Citation (RFC), Fidelity Level (FL), and Factor Informant Consensus (FIC) measures. Following the methods described by, [64] RFC was calculated as:

RFC= FC/N

Where FC = Frequency of citation, and N = number of participants in the survey.

The fidelity level was calculated as described. [22]

$FL = \left(\frac{Ip}{Iu}\right) \times 100$, where Ip = Number of respondents that mentioned a particular plant species used to treat an ailment being considered, and Iu = Total number of respondents in the survey.

FIC = Informant consensus factor was calculated as described by. [40]

FIC = Nur- $\frac{NT}{Nur}$ -1, where Nur refers to the number of use citations in each category and Nt to the number of the species used

Results and Discussion

Demographic information

The interview started by assessing the participants' demographic profile (Table 1). Forty-five (45) informants aged 45 - 75 years took part in the study. The majority of the participants in this study were male (89%), which can be attributed to cultural and religious beliefs prevalent in northern Nigeria, particularly among the Fulani and Hausa communities. These traditions impose restrictions on women's interactions with men, limiting their participation in various businesses and activities. It is generally believed that in traditional medicine systems, knowledge of medicinal plants is passed down from father to first-born son. This view corresponds to previous study results. [16, 71] Females typically acquire traditional knowledge through routine observations of their parents, while males receive direct instruction from their fathers in addition to observational learning. This is because traditional knowledge is often transferred within families or communities from the male parent to his eldest son. [10] The respondents were mature males and females known as elders and traditional healers of the community. Respondents aged 45–55 constituted the largest demographic group, accounting for 57% of the participants. Males represented the majority, comprising 89% of the total respondents. The primary occupations reported were herb vendors (46.7%), followed by traditional health practitioners (31%). The participants included individuals from the Fulani, Kakka, Mambila, Ndoroh, and Nkambo ethnic groups. Variations in gender, age, and educational background are recognized as significant factors influencing ethnomedicinal knowledge, as noted by .[12]

Table 1: Demographic information of the respondents

Table 1: Demographic information of the respondents

Variable	Sub-group	Number	Percentage (%)

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Age	45-55	15	33.3
	55-65	25	55.6
	65-75	5	11.1
Gender	Male	40	89.0
	Female	05	11.0
Marital Status	Married	45	100.0
Tribe	Fulani	9	20.0
	Kakka	9	20.0
	Mambila	9	20.0
	Ndoroh	9	20.0
	Nkambo	9	20.0
Occupation	Traditional health practitioners	14	31.1
	Herb vendors		
	Farmers	21	46.7
	Others	8	17.8
		2	4.4

Diversity of medicinal plants and their conservation status

Different habits of the plants, such as shrubs (3), lianas (3), and trees (351), were found in the study area. This study identified 40 species from 25 families, out of the 351 plant species seen in the transects of the study area, as being traditionally used by local communities close to the Ngel-Nyaki Forest Reserve for the management of different ailments (Table 2). Among the families, Euphorbiaceae had the highest number of species, representing (11.90%) of the total, followed by Moraceae (9.52%). Apocynaceae, Meliaceae, and Fabaceae each accounted for (7.14%). Myrtaceae, Araliaceae, Rutaceae, Combretaceae, Anacardiaceae, Rosaceae, Ochnaceae, and Simaroubaceae each accounted for (4.76%). The remaining families each accounted for (2.38%) respectively.

The study documented plant species along with their GPS coordinates and conservation status (Table 2). Identified plant species were checked for their conservation status by consulting the Red List of Threatened Species (https://www.iucnredlist.org/) database. Three species *Eugenia gilgii*, *Dombeya ledermannii*, and *Milletia barteri*, were classified as critically endangered.

The roots of *Eugenia gilgii* are traditionally utilized by the local communities for the treatment of arthritis. In addition to their medicinal value, these plants are employed as a source of firewood and for crafting banga sticks. *Dombeya ledermannii* is primarily used by the local communities for the treatment of gonorrhea, with the roots being the main part utilized. This species also provides materials for spear-making and house construction. Although limited information is available regarding *Milletia barteri*, it is recognized for its blood-clotting property, aiding in blood clotting, particularly in cases of cuts or accidental injuries.

Milletia barteri (Critically endangered) and *Entandrophragma angolense* (Near Threatened A3d ver 3.1) are listed in the IUCN Red Data, as noted by. [10] *Eugenia gilgii* and *Dombeya ledermannii* are classified as critically endangered in the IUCN Red List (2000) under criteria A1c, while *Prunus africana* is listed as vulnerable under criteria A2cd+4cd in the 2020 assessment. *Zanthoxylum leprieurii* was observed dead while standing. The roots of this species are traditionally used as an analgesic and for treating rheumatism, while the bark is utilized for toothache treatment. However, the plant parts employed (bark and roots) are non-meristematic tissues, which cannot regenerate, posing a risk to the species' sustainability.

The roots of *Prunus Africana*, are utilized by the communities for the treatment of cancer, which was also reported in Africa, [49, 24] and is also harvested for timber in this study. Another plant called *Entandrophragma angolense* is administered for the treatment of malaria and stomach pain in the present study. Similarly,[33] has reported the anti-malarial effects of the plant against *Plasmodium berghei*, with its bark and leaves being the primary parts used in this study; the species is also extensively logged for timber. Malaria remains endemic in Nigeria, particularly in the highland regions. [5, 46] Therefore, *E. angolense* could be employed in the management of malaria via scientific validations.

Plant parts used, vernacular names, methods of preparation, and the ailments treated.

The medicinal plants documented in this study are utilized in the treatment of various ailments, including menstrual disorders, fever, rheumatism, aphrodisiacs, cough, and dysentery, among others (Table 2). Before administration, the patient's condition is assessed, and herbal remedies are administered orally with dosages adjusted according to age. Notably, several plants are used to treat multiple diseases (Table 2). For example, the herbal parts of *Entandrophragma angolense*, identified to have more than one medicinal use, including yellow fever and analgesics. *Antidesma venosum* for syphilis and tooth decay, *Parkia filicoidea* for leprosy and hemorrhoids, *Bridelia speciosa* for typhoid and toothache, *Santiria trimera* for general body pain and enhancing manpower (aphrodisiacs), *Ficus lutea* for typhoid and rheumatism, *Allanblackia sp* for cough, asthma, and bronchitis, and *Syzygium guineense* for piles and stomach pain.[42, 68]

Traditional healers use herbal remedies to treat common diseases such as fever, skin diseases, worm infestation, piles, erectile dysfunction, and bronchial infection. The most common method of administration was oral administration, and the most common method of preparation was decoction. This agrees with the findings of. [31] The medicinal use of plants in the Ngel-Nyaki forest reserve has not been documented until the performance of the present study.

Informant consensus

The reported ailments were categorized into 13 groups based on information gathered from the respondents. Table 4 presents the FIC (Factor Informant Consensus) values for these ailment categories. The category with the highest FIC score was Analgesic and Rheumatism (0.93), with plant remedies such as *Zanthoxylum leprieurii*, *Santiria trimera*, *Ficus lutea*, and *Clausena anisata* commonly cited for this purpose.

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Table 2: List of Medicinal Plants species, frequency count percentage, GPS Coordinates, and their Conservation status in Ngel-Nyaki forest reserve Taraba state, Nigeria

Species/Voucher No.	Family	Vernacular	Vernacular language	PU	Ailment	Mth. of. Prep.	ROA	FC	RFC	FL	Lat/Long	CS
Albizia gummifera (J.F.Gmel) DBSH752	*Fabaceae*	Dauruwa leinde	Fufulde	Bark	Bronchial infection	Decoction	oral	19	0.4	42	07º04.752N 011º03.317E	LC
Allanblackia sp (Oliv. exBenth) DBSH2217	*Clausiaceae*	Hulba	Hausa	Bark, Leaves	Cough, asthma, bronchitis	Decoction	oral	1	0.02	2	07º04.499N 011°02.936E	LC
Anthocleista vogelii (Planch. 1848) DBSH185	*Gentianaceae*	Kwari	Hausa	Bark	Purgatives	Decoction	oral	6	0.13	13	07º04.856N 011º04.171E	LC
Antidesma venosum E.Mey. ex Tul. DBSH1903	*Euphorbiaceae*	Kirni	Hausa	Bark	Syphilis, Tooth decay	Decoction	oral	1	0.02	2	07º04.895 N011º03.018E	LC
Bridelia speciosa Müll.Arg DBSH2221	*Euphorbiaceae*	Mburumburu Jar	Fufulde Mambilla	Bark, Roots	Tooth pain, Y.fever	Decoction	oral	34	0.76	76	07º04.719N 011º03.258E	LC
Brucea antidysentrica J.F.Mill. DBSH781	*Simaroubaceae*	Hantsi	Hausa	Bark	Dysentery	Decoction	oral	2	0.04	4	07º05.657N 011°03.121E	LC
Clausena anisata Hook.f. ex Benth. DBSH1872	*Rutaceae*	Ledde daneji	Fulfulde	Roots, Leave	Rheumatism	Decoction	oral	3	0.07	7	07º04.077N 011º03.218E	LC
Combretum molle R.Br. ex G.Don DBSH2423	*Combretaceae*	Sakatahi Veer	Fufulde Mambila	Bark, Roots	Typhoid & worms	Decoction	oral	38	0.84	84	07º04.919N 011º03.003E	LC
Cordia millenii Baker DBSH2425	*Boraginaceae*	Bokoko	Hausa	Bark	Cough	Decoction	oral	1	0.02	2	07º04.682N 011°03.135E	LC
Croton macrostachyus Hochst. ex Delile DBSH 2104	*Euphorbiaceae*	Ledde daneji	Fulfulde	Bark	Purgatives	Decoction	oral	9	0.2	20	07º04.854N 011º03.086E	LC
Cussonia arborea Hochst. ex A.Rich DBSH763	*Araliaceae*	Bummalee-hi	Fufulde	Bark	Dehydration	Decoction	oral	1	0.02	2	07º05.893N 011°03.254E	LC
Discoclaoxylon hexandrum (Müll.Arg.) DBSH2092	*Euphorbiaceae*			Bark, Roots	Typhoid & stomachache	Decoction	oral	10	0.22	22	07º04.235N 011°03.188E	LC
Entada abyssinica A.Rich DBSH2290	*Fabaceae*	Pelwahi Boom	Fufulde Kakka	Bark, Roots	Worm & Haematenics	Decoction	oral	7	0.16	16	07º04.915N 011º03.013E	LC
Entandrophragma angolense (Welw). Panshin DBSH777	*Meliaceae*	Ayaa-Ayaa	Hausa	Bark, Roots	Malaria, Y.fever &, Stomachache	Decoction	oral	17	0.38	38	07º04.796N 011º03.301E	NT
Erythrorococca hispida (Pax) PrainDBSH1989	*Euphorbiaceae*	Balei nyamnyam	Fufulde Mambila	Bark	Dermatitis	Powder	Body bath	1	0.02	2	07º04.090N 011°03.359E	LC
Eugenia gilgii Engl. & Brehmer DBSH1858	*Myrtaceae*	Mambillaru	Fulfulde	Bark	Fertility	Concoction	oral	5	0.11	11	07º04.544N 011º03.306E	CE
Ficus exasperate Vahl DBSH2222	*Moraceae*	Baure	Hausa	Leaves	Dermatitis	Powder	Body bath	2	0.04	4	07º05.702N 011°03.143E	LC
Ficus lutea Vahl DBSH2017	*Moraceae*	Cediyahi Bob	Hausa Mabila	Leaves	Rheumatism	Decoction	oral	13	0.29	29	07º03.883N 011º02.965E	LC
Ficus sp L. DBSH2020	*Moraceae*	Ibbe beraje Bol	Mambilla	Bark	Cough	Decoction	Steam/oral	9	0.2	20	07º04.745N 011º03.364E	LC
Ficus sur Forssk. DBSH1775	*Moraceae*	Tagar Rima becehi	Mambilla Fulfulde	Roots	Amenorrhea	Decoction	oral	13	0.29	29	07º04.791N 011º03.169E	LC
Dombeya ledermannii DBSH2011	*Sterculiaceae*	Mijin-Kurmii	Hausa	Leave	Blood clot	Decoction	dermal	4	0.08	9	07º06.089N 011°03.368E	CE

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HMC DBSH405	*Nil*			Bark, Roots	Stomachache, Manpower	Decoction, Powder	oral	1	0.02	2	07º05.392N 011°03.629E	LC
Kigelia Africana (Lam.) Benth. DBSH606	*Bignoniaceae*	Jirlahi Killaare	Ndoroh Fufulde	Roots & stem	Typhoid	Decoction	oral	2	0.04	4	07º07.294N 011°02.199E	LC
Lannea barteri (Oliv.) Engl. DBSH522	*Anacardiaceae*	Saiye	Fufulde	Bark, Roots	Haematenics, scurvy	Decoction, Chewing	oral	2	0.04	4	07º04.702N 011°03.058E	LC
Memecylon afzelii G.Don DBSH523	*Melastomataceae*			Roots	Man Power	Concoction	oral	2	0.04	4	07º04.809N 011º03.146E	LC
Parkia filicoidea Oliv DBSH850	*Fabaceae*	Theel	Mambila	Root	Gonorrhea	Decoction	oral	6	0.13	13	07º04.782N 011º03.405E	LC
Polyscias fulva (Hiern) Harms DBSH278	*Araliaceae*	Dauruwa Nareje	Hausa	Bark	Dermatitis	Decoction	Body bath	27	0.6	60	07º07.465N 011°02.293E	LC
Prunus Africana (Hook.F)Kalkman DBSH 279	*Rosaceae*	Vernacular	Fufulde	Roots	Cancer & Gonorrhea	Decoction	oral	3	0.07	7	07º04.893N 011º04.225E	V
Psorospermum aurantiacum Engl DBSH305	*Hypericace*	Dauruwa leinde	Hausa	Bark	Y.fever	Decoction	oral	6	0.13	13	07º04.915N 011º04.225E	LC
Rauvolfia vomitoria Afzel., 1817 DBSH577	*Apocynaceae*	Hulba	Fufulde	Bark	Dermatitis	Powder	Body bath	1	0.02	2	07º03.892N 011º03.007E	LC
Santiria trimera (Oliv) Aubrév DBSH296	*Burseraceae*	Kwari	Fufulde	Bark, Roots	Stomachache, analgesics & Fever	Decoction	oral	9	0.2	20	07º04.820N 011º03.126E	LC
Symphonia globulifera L.F. DBSH555	*Clauseaceae*	Kirni		Roots	Manpower	Decoction	oral	9	0.2	20	07º04.853N 011º04.172E	LC
Syzygium guineense Wall. DBSH2466	*Myrtaceae*	Mburumburu Jar	Fulfulde	Bark	Manpower	Concoction	oral	43	0.95	96	07º04.770N 011º03.203E	LC
Tabernamontana contorta (Stapf) DBSH2016	*Apocynaceae*	Hantsi	Mambilla Fufulde	Bark, Roots	Worms & Stomachache	Decoction, Powder	oral	14	0.31	31	07º04.874N 011º02.978E	LC
Milletia barteri (Benth.) Dunn DBSH565	*Papilonoideae*	Ledde daneji	Nkambo Fufulde	Roots	Stomachache	Decoction	oral	4	0.08	9	07º04.680N 011°03.169E	CE
Vitex donniana (Sweet) DBSH2516	*Verbanaceae*	Sakatahi Veer	Fufulde Hausa	Bark, Roots	Y.fever, Leprosy	Decoction, Powder	Oral/dermal	2	0.04	4	07º04.547N 011º03.227E	LC
Vocanga bracteata (Stapf) DBSH209	*Apocynaceae*	Bokoko	Fufulde	Bark, Roots	Typhoid & stomachache	Decoction	oral	8	0.18	18	07º04.127N 011°03.129E	LC
Warneckia cinnamomides (Sick) DBSH1044	*Melastomataceae*	Ledde daneji		Roots	Man Power	Decoction	oral	3	0.07	7	07º04.746N 011º03.313E	LC
Xylopia acutiflora A. Richard DBSH1255	*Annonaceae*	Bummalee-hi	Fufulde	Fruits	Erectile dysfunction	Edible	oral	2	0.04	4	07º04.645N 011º03.252E	LC
Zanthoxylum leprieurii Guill. & Perr. DBSH0096	*Rutaceae*		Hausa	Roots	Analgesics & rheumatism	Decoction	oral	17	0.38	38	07º04.901N 011º03.027E	DS

Keys: PU- Part Used, ROA- Route of Administration, FC- Frequency of Citation, RFC- Relative Frequency of Citation, FL- Fidelity Level, CS- Conservation Status, LC- Least Concern, NT- Near threatened, CE- Critically Endangered, V- Vulnerable, DS- Dead Standing.

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Table 3: Informant consensus factor (FIC) for different ailment categories in Ngel-Nyaki forest reserve Taraba state, Nigeria

Use category	Number of species (Nt)	Number of use reports (Nur)	FIC
Dermatological disorders	4	31	0.9
Scurvy	1	2	1.00
Gastrointestinal/Typhoid	11	37	0.72
Hemorrhoids	4	25	0.87
Hematinic	3	10	0.77
Analgesic, and Rheumatism	3	33	0.93
Fertility	2	7	0.83
Respiratory and throat diseases	4	30	0.89
Sexually transmitted diseases (STIs)	4	10	0.66
aphrodisiac	5	58	0.92
Blood clot	1	4	1.00
Toothache	11	34	0.69
Leprosy	1	2	1.00

The second highest FIC value was recorded for Aphrodisiacs (0.92), followed by Dermatological Disorders (0.90) as the third. Respiratory and Throat Diseases ranked fourth with an FIC value of 0.89, while Hemorrhoids was fifth at 0.87. Fertility ranked sixth with an FIC value of 0.83.

At the seventh level, Hematinic recorded an FIC value of 0.77. The lowest rankings in the list were Sexually Transmitted Diseases (FIC = 0.69) and Toothache (FIC = 0.66). This may be attributed to limited communication among informants practicing within this ailment category in the study area, [56] or to the low prevalence of sexually transmitted diseases and toothache within the local communities. Notably, some ailments, including Scurvy, Blood Clots, and Leprosy, achieved complete consensus among informants, with an FIC value of 1.00.

The high FIC values highlight the strong traditional reliance and high level of knowledge shared among users in the study area regarding the utilization of medicinal plants for treating ailments, emphasizing their potential for bioactive compound research. For instance, a study conducted by [65] the largest proportion of species was reported to be used for gastrointestinal disorders (11.21%), followed by immuno-modulation, anti-stress, and adaptogenic properties (10.2%), analgesics (7.47%), nervous system-related disorders (6.54%), and antimicrobials (6.54%). In their analysis, the highest informant consensus factor (FIC) value was observed for analgesics and rheumatism, with a value of 0.93, while in this study, the FIC value for analgesics was 7.47, ranking third in their study. Additionally, [63] reported an FIC range of 0.63 to 0.93, which is comparable to the findings of this research, where the FIC values range between 0.66 and 0.93.

The respondents in the study area reported the utilization of various plant parts, including bark, roots, leaves, stems, and fruits, for medicinal purposes (Figure 2). Among these, bark was the most frequently utilized, comprising 47% of reported usage, followed by roots at 37%, while fruits were the least utilized, accounting for only 2%. These findings are consistent with previous studies, [18, 61] which highlighted that bark and roots are the most commonly used plant parts in traditional medicine. Similarly, [57] documented the predominant use of roots and bark in traditional medicinal practices. Notably, a significant number of the medicinal plants and formulations identified in this study are being reported for the first time in the study area.

Figure 2: Percentage of plant parts used for the preparation of medicine

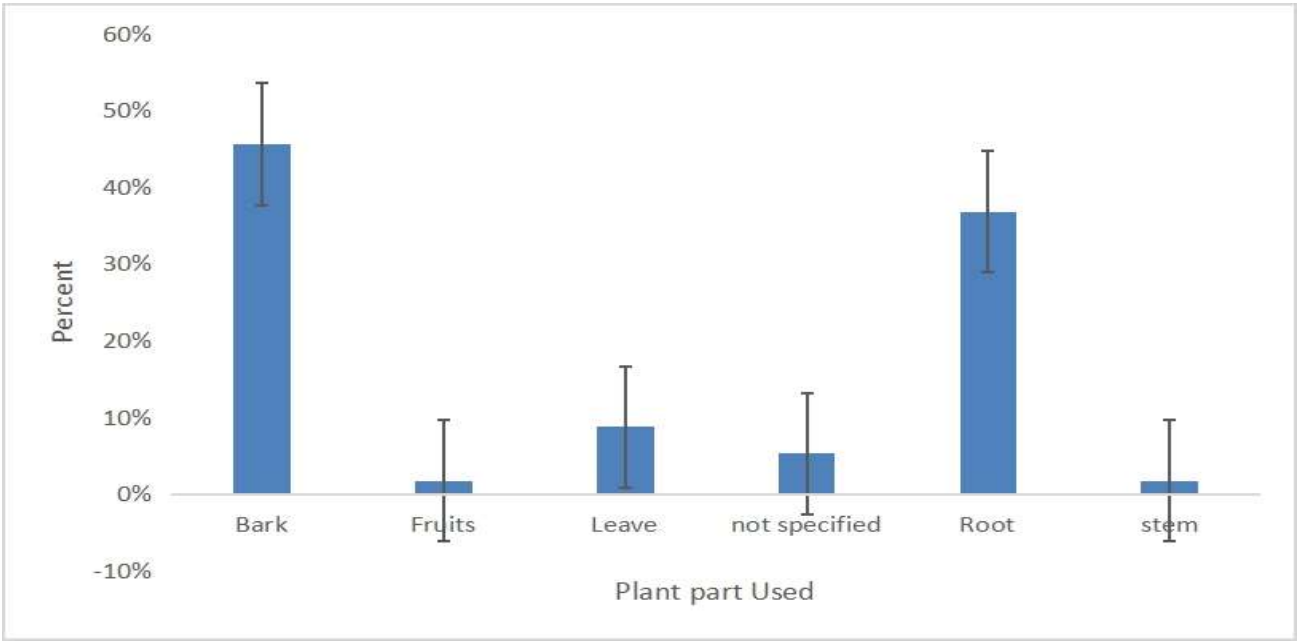

Figure 2: Percentage of plant parts used for the preparation of medicine in Mambila Plateau Taraba state, Nigeria

Medicinal Plants and the Families Recorded

In total, 40 plant species belonging to 25 families are documented for the treatment of a range of ailments. The family Euphorbiaceae had the highest number of species (11.90%) of the total, followed by Moraceae (9.52%). Apocynaceae, Meliaceae, and Fabaceae each accounted for (7.14%). Myrtaceae, Araliaceae, Rutaceae, Combretaceae, Anacardiaceae, Rosaceae, Ochnaceae, and Simaroubaceae each accounted for (4.76%). The remaining families each accounted for (2.38%) (Figure 3). Euphorbiaceae family, the spurge family, accounts for the fifth most varied family of flowering plants. [13] Most spurges,

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such as *Euphorbia paralias* are herbs; however, shrubs or trees in the tropics, such as *Croton Macrostachyus*, [70, 6] are found worldwide. The Euphorbiaceae family has numerous species distributed in non-tropical zones of all continents. [3]

The Euphorbiaceae family is rich in diverse phytochemicals, including diterpene esters, alkaloids, and cyanogenic glycosides. [59, 17] Phytochemicals found in Euphorbiaceae species include diterpenoids, terpenoids, flavonoids, alkaloids, tannins, neriifolins (also found in oleander), cycloartenol, lectin, and taraxerol, among others. [38, 14]

Molecular studies conducted in the 21st century have provided insight into the enigmatic family Rafflesiaceae, now recognized as belonging to the order Malpighiales is equally from within the Euphorbiaceae family. [66] Certain varieties are grown as decorative plants, and include poinsettia (*Euphorbia pulcherrima*) and Garden croton (*Codiaeum variegatum*). Leafy spurge (*Euphorbia esula*) and Chinese tallow (*Triadica sebifera*) are invasive weeds in North America. [54] Seeds of the castor oil plant, for example, produce a powerful toxin, ricin. [21, 1] Though numerous species of Euphorbiaceae have been used in traditional medicine. [41]

People in the Mambila Plateau residing near the reserve use some species from the Euphorbiaceae family for the treatment of ailments such as Yellow fever, syphilis, toothache, stomachache, and dermatitis, and some species serve as a purgative. Nevertheless, there is evidence that euphol, a tetracycline triterpenoid alcohol, and the main constituents of the sap of the medicinal plants, Euphorbia. [30] Similarly, the Euphorbiaceae family is reported to have strong anti-microbial, antioxidant, anti-inflammatory, and anti-cancer activities. For example, [36] reported quercitrin in E. hirta is acclaimed for antidiarrheal effects. Latex contains proteins like lectins and lysozymes, which serve as a potential anti-microbial property. [35]

The family Euphorbiaceae, identified as the most abundant in this study, has been widely reported to be used in traditional medicine to treat various ailments such as infections, inflammation, pain, and snake bites. Their effectiveness is linked to bioactive compounds like polycyclic and macrocyclic diterpenes with diverse pharmacological properties. [34]

Figure 3: Frequency of plant families used for treatments of ailments

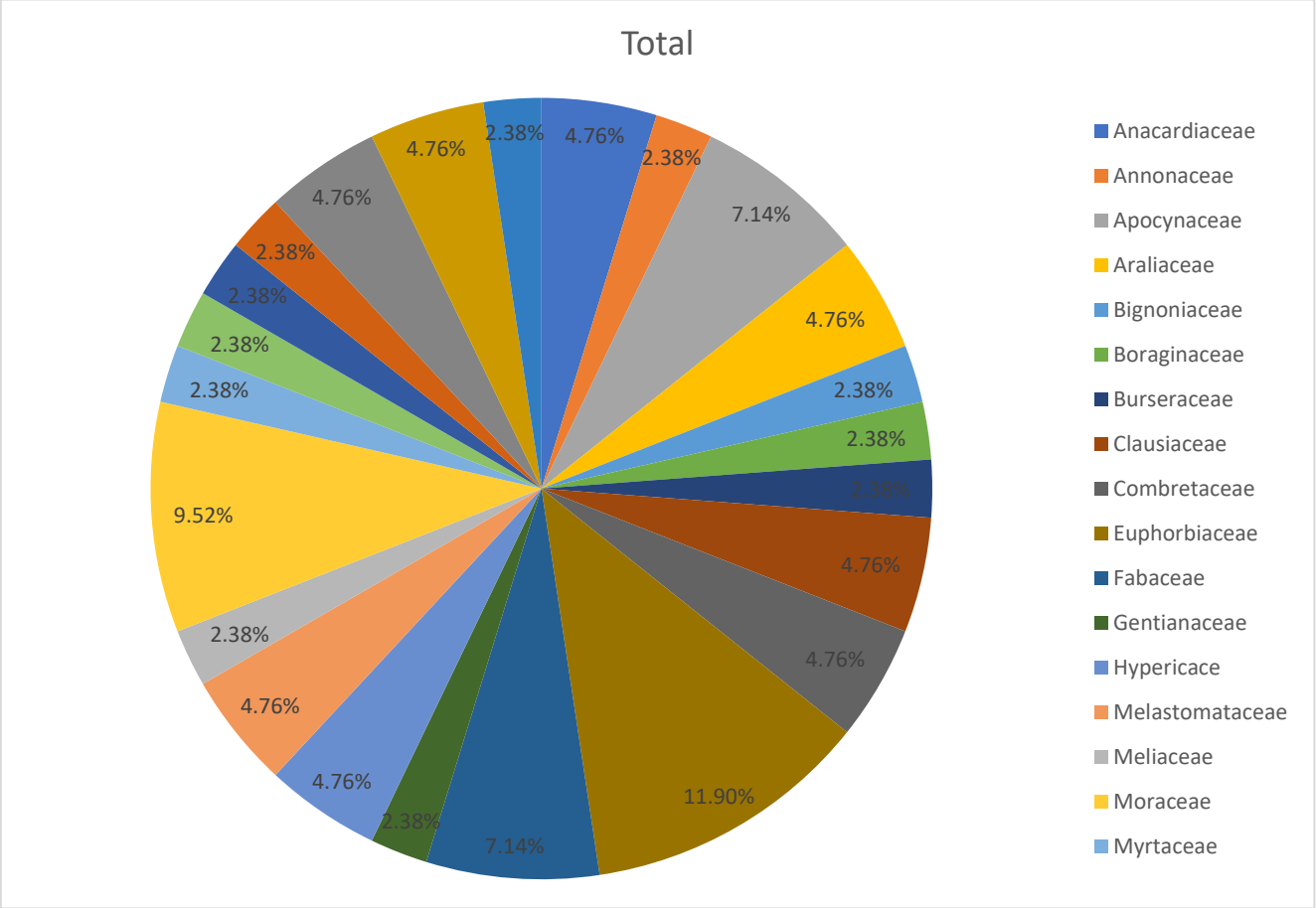

Figure 3: Frequency of plant families used for treatments of ailments in Mambila Plateau Taraba state, Nigeria

Conclusion

The present study demonstrated that traditional medicines are widely utilized by the communities residing around the Ngel-Nyaki Reserve, with these communities possessing substantial knowledge of the plants and their medicinal properties. However, a detailed investigation of the ethnobotanical knowledge specific to each community is necessary to prevent the loss of this valuable information. Plants identified with the highest fidelity levels and use values in this study may signify the presence of valuable phytochemical compounds, calling for further exploration for the development of potential new drugs to treat various ailments.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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