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ETHNOBOTANICAL STUDY OF TWENTY SPECIES IN THE FAMILY ASTERACEAE IN ILE-IFE, OSUN STATE, NIGERIA

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ABSTRACT

Ethnobotanical study was conducted on 20 plants belonging to 18 genera of the Asteraceae family. The aims of this research were to explore the current ethnobotanical status of the identified plant species, document their indigenous utilization for diverse purposes within the specific research area and assess the extent of Asteraceae plant usage by the local population. Data were collected through semi-structured questionnaires and open-ended interview techniques with different categories of informants in the Ife Central Local Government Area of Ile-Ife, Osun State, Nigeria. Demographic data of respondents were analyzed using a descriptive statistical method, providing understandings into their characteristics. The ethnobotanical survey results were subjected to quantitative analysis employing several parameters. The Relative Frequency of Citation (RFC) was utilized to determine the prominence of plant species in terms of citations. The Use Value (UV), Fidelity Level (FL), and Informant Consensus Factor (ICF) were employed to assess plant importance, therapeutic efficacy, and consensus among informants, respectively. Ethnobotanical study of the selected Asteraceae plants revealed the traditional uses of these plants for diverse purposes for both humans and livestock. The average ICF value was 0.92, indicating a relatively high consensus among the respondents. *Ageratum conyzoides*, *Tithonia diversifolia*, *Aspilia africana*, *Launaea taraxacifolia* and *Tridax procumbens* were the most cited of all the species, hence their high RFC values. Fidelity Level (FL) had the highest value in *Aspilia africana*, *Tithonia diversifolia* and *Ageratum conyzoides* while *Acmella radicans* had the lowest FL value. According to this study, *Ageratum conyzoides* (0.10) and *Launaea taraxacifolia* (0.10) had the highest use value. The study concluded that the Asteraceae species have several edible, ornamental and medicinal uses, which have not been explored extensively in the study area.

Keywords: Asteraceae, Ethnobotany, Fidelity Level, Use Value, Informant Consensus Factor, Relative Frequency of Citation.

INTRODUCTION

Asteraceae family, also known as Compositae, the daisy family, sunflower family or thistle family, is one of the largest family of flowering plants comprising over 27000 species and over 16000 genera (Funk *et al.,* 2005). The family has 12 subfamilies and 43 tribes and is distributed in all continents of the world except the Antarctica (Byng, 2004). Asteraceae is renowned for its advanced evolution and is comparable to Orchidaceae among monocots for its broad range of adaptations in morphology, anatomy, physiology, and ecology, which facilitate widespread distribution, dissemination, and reproductive success. These adaptations have played a significant role in the success of the family and have contributed to its status as one of the most advanced among angiospermic plant families (Heywood *et al.,* 2007).

The family Asteraceae exhibits a wide range of morphological diversity. While some species, such as *Vernonia arborea*, are rarely trees that do not exceed 30 cm in height, many others are shrubs, perennials, or annual herbs that range from 1-3 meters in height, from sunflowers to nearly sessile forms. The leaves of Asteraceae plants also exhibit a great deal of variety; the majority of Asteraceae plants exhibit a considerable size, but certain species display small stature and spiny characteristics, while others lack leaves altogether, relying on the green stem for their functions. Furthermore, Asteraceae leaves commonly possess indentations and hairs of varying lengths and colors, contributing to their distinctive appearance and texture. This vast array of morphological diversity within Asteraceae is likely due to the advanced evolutionary history of the family, which has allowed for adaptation to a wide

range of environments and ecological niches. This diversity has enabled the family to become one of the most successful plant families, with members found on every continent except Antarctica. Understanding the morphological adaptations of Asteraceae is crucial in comprehending the ecological success of the family and the role it plays in ecosystems worldwide (Bohm and Stuessy, 2001).

A prominent attribute of Asteraceae is the occurrence of densely clustered flowers within a compacted inflorescence referred to as a capitulum or head. This structure mimics a solitary, substantial flower, serving as an enticing unit that attracts pollinators. This unique arrangement enhances pollination efficiency and aids in the reproductive success of the family. This morphological specialization is regarded as a key factor in the evolutionary success of the family, allowing for efficient pollination and reproduction. Studies have reported that this adaptation was one of the key factors that led to the success in diversification and widespread distribution of the family (Funk *et al.,* 2005).

The Asteraceae family is considered to be of significant economic importance, as it includes a wide variety of plants that are utilized for various purposes. Some examples of oil-producing plants within the family include Sunflower and Safflower. The family also includes several vegetables such as Artichokes and Lettuce. Ornamental plants like Dahlias, Zinnias, Cosmos, Asters, Sunflowers, Marigolds, and Chrysanthemums are also members of this family. Some of the family members are categorized as weeds, such as Dandelion, Ragwort and Troundsel (Funk *et al.,* 2007). The commercial sunflower genus *Helianthus* has been used as a model in the study of hybridization and its role in speciation (Rieseberg *et al.,* 2003). The vast majority of Asteraceae species possess notable medicinal properties and applications, and have been utilized in traditional medicine for a prolonged period; some of these species have been grown for food and medicine for over three thousand years. Asteraceae plants exhibit diverse biological activities, encompassing antibacterial, antioxidant, anti-inflammatory, and hepatoprotective properties. These numerous characteristics have attracted academic attention, emphasizing the family's pharmacological potential in various fields of research due to its rich reservoir of bioactive compounds (Achika *et al.,* 2014).

Ethnobotany is the study of how people classify, manage and utilize plants. It is defined as "local people's interaction with the natural environment: how they classify, manage and use plants available around them" (Maurice, 2002). Indigenous knowledge or traditional knowledge is the term used to describe these intricate systems of knowledge, beliefs, which is specific to their local environments since the dawn of humanity.

Members of this family are commonly used in Nigeria for ethnomedical purposes. Young shoots of *Bidens pilosa* are used to treat rheumatism, while its blooms can treat diarrhea and its roots and leaves can be infused to treat colic. A clinical study has shown that *Emilia praetermissa* possesses anticoagulant properties and is effective in reducing hyperlipidemic conditions (Mermariani *et al.,* 2018). Other Asteraceae species are reported to demonstrate efficacy in treating skin conditions such as eczema, ringworm, scabies, and leprosy. Leprosy and skin scars are treated with *Ageratum conyzoides*. Leaf paste of *Eclipta alba* is most effective to treat eczema. An infusion of *Tithonia diversifolia* is used in treating malaria, liver ache, indigestion, stomach pain, and sore throat. Additionally, it has anti-inflammatory, analgesic, antimalarial, antidiabetic, antidiarrheal, antipasmodic, vasodilator, and cancer-chemopreventive activities (Ahmed and Onocha, 2013). *Crassocephalum crepidioides* has a history of traditional use in treating multiple ailments, such as epilepsy, hepatotoxicity, indigestion, tumors, eczema, ringworm, scabies, and leprosy (Bahar *et al.,* 2016).

MATERIALS AND METHODS

Study Area

The research was conducted in the Ife Central Local Government of Ile-Ife, Osun State, Nigeria, which lies between latitudes 7º28'43.5"N and 7º34'51.41"N and longitudes 4º27'22.5"E and 4º35'40.61"E (Figure 1).

Areas of Collection

The Asteraceae plant samples examined in this

study were collected from various random locations in Obafemi Awolowo University, Ile-Ife and off campus areas in Ile-Ife, Osun State, which lie on the geographical coordinates 7º29'25.66"N and 4º33'7.66"E in South West, Nigeria (Figure 2)

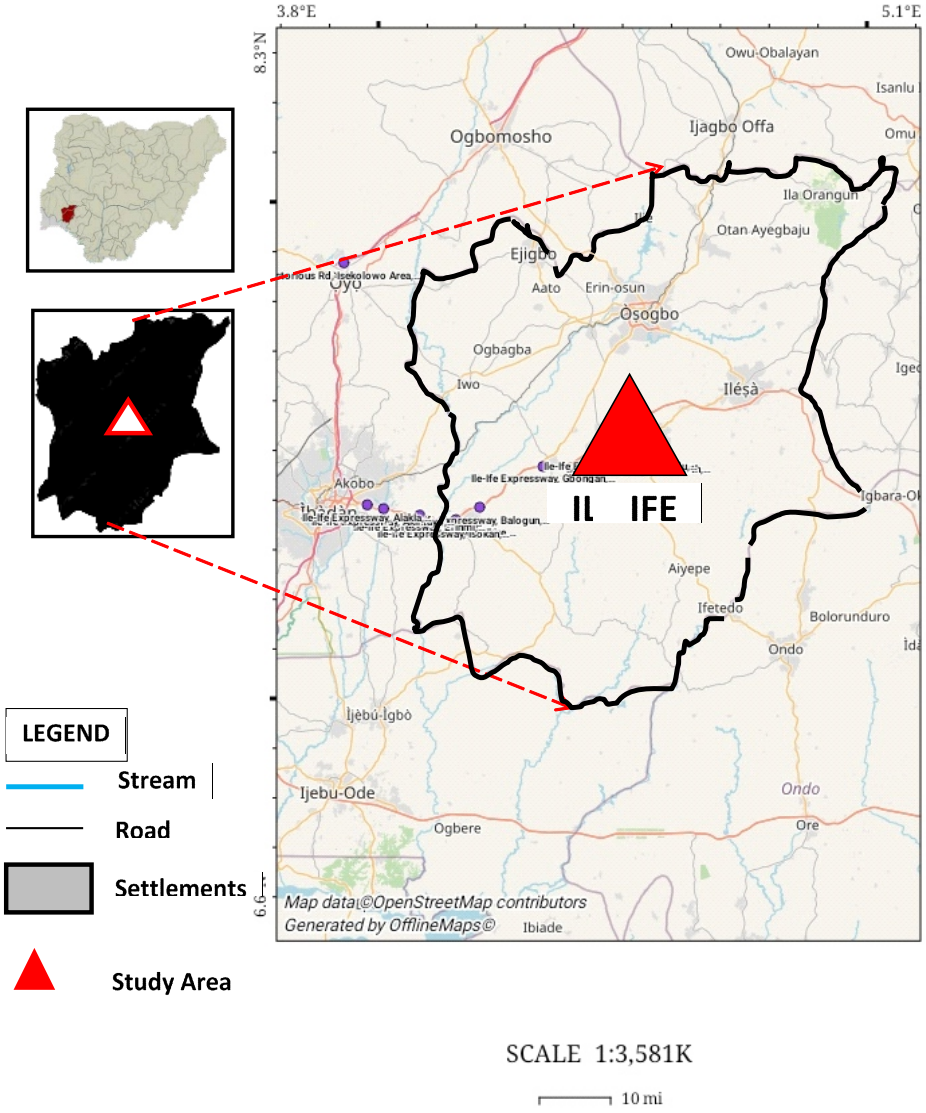

Figure 1: Map of Osun State Showing the Study Area (Ile-Ife)

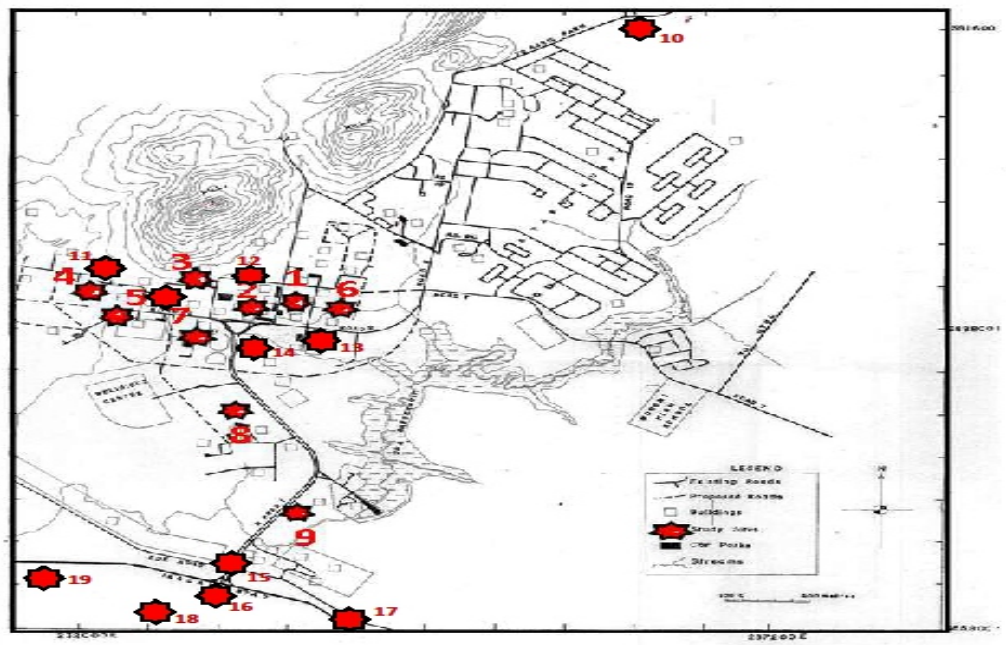

Figure 2: Identification Keys to Numbers Shown on the Map

1 = Botany Department; Department of English and Literary Studies
2 = Senate Building; Hezekiah Oluwasanmi Library
3 = Faculty of Administration
4 = Health Centre; MMPHR
5 = Humanities Building 1
6 = Natural History Museum; College of Health Sciences; Faculty of Pharmacy; New EDM Faculty Building.
7 = Moremi Hall; Sports Centre
8 and 9 = Along Road 1 (Adesoji Aderemi Road)
10 = O.A.U. Teaching and Research Farms
11 = Chemical Engineering Department
12 = Geology Department
13 = Bus Stop Area
14 = First Bus Stop, Along Banking Area
15 = O.A.U. Campus Gate; Opposite Campus Gate (Ede Road)
16 = Aserifa, Ibadan Road
17 = Mayfair Roundabout
18 = Modomo, Ede Road
19 = Modakeke Road

Figure 2: A cartographic representation illustrating the collection points of the selected Asteraceae species studied within Obafemi Awolowo University, Ile-Ife and Off Campus areas.

Species of Asteraceae Studied

For the purpose of this study, the 20 species of Asteraceae studied are:

Acanthospermum hispidum DC, *Acmella radicans* (Jacq.) R.K. Jansen, *Ageratum conyzoides* L., *Ageratum houstonianum* Mill, *Aspilia africana* (Pers.) C.D. Adams, *Bidens pilosa* L., *Blumea perrottetiana* DC, *Chromolaena odorata* (L.) R.M. King & H. Rob, *Crassocephalum crepidioides* (Benth.) S. Moore, *Eclipta alba* (L.) Hassk., *Eleutheranthera ruderalis* (Swartz) Sch. Bip., *Emilia praetermissa* Milne-Redh., *Emilia sonchifolia* (L.) DC. ex Wight, *Launaea taraxacifolia* (Willd.) Amin ex C. Jeffery, *Melanthera scandens* (Schum. & Thonn.) Roberty, *Synedrella nodiflora* (L.) Gaertn., *Tagetes erecta* L., *Tithonia diversifolia* (Hemsl.) A. Gray, *Tridax procumbens* L. and *Vernonia cinerea* (L.) Less.

Ethnobotanical Survey

An Ethnobotanical survey of the selected species was conducted. Information was gathered through semi-structured questionnaires and open-ended interview techniques (Martin, 1995; Alexiades and Sheldon, 1996) with herbalists, herb sellers, head of households and a few other categories of informants in randomly selected points in the Ife Central Local Government of Ile-Ife, Osun State, taking into consideration different aspects such as gender, age, level of education and occupation. In this regard, 200 questionnaires were prepared, out of which 118 were administered. The process of selecting informants adhered to the methodologies outlined by Martin (1995), which emphasized the significance of carefully choosing key informants when documenting indigenous knowledge controlled by ethnobotanical healers or specific

social groups. This approach ensured the acquisition of valuable and reliable information pertaining to ethnobotanical practices. The key informants shared their knowledge on the ethnobotanical uses of each plant and the plant parts used. The checklist of information about the ethnobotanical uses of these plants was compiled and documented. Department of Botany, Obafemi Awolowo University and the IFE herbarium identified these collections. Relevant literatures such as The Flora of West Tropical Africa by Hutchinson and Dalziel (1963) was also consulted to ascertain the identity of each species. The species were preserved and assigned voucher numbers in the IFE Herbarium. GPS coordinates of the locations of each plant were documented. Pictorial representations of these plants were made using a digital camera. Biological illustrations of these plants were made at the Natural History Museum of Obafemi Awolowo University, Ile-Ife, Osun State. The results of the ethnobotanical survey were analyzed using a combination of ethnobotanical information and descriptive data analysis techniques, such as frequency and percentage calculations. Socio-demographic data from survey participants was analyzed using descriptive statistical methods. Furthermore, several specific indices were employed to analyze the ethnobotanical survey results, including the Relative Frequency of Citation (RFC), Use Value (UV), Fidelity Level (FL), and Informant Consensus Factor (ICF). These indices allowed for a comprehensive examination of the selected plant species' importance to the local community, as well as providing insight into the community's knowledge and use of the plants. The results of these analyses are envisaged to contribute to the development of sustainable conservation and management strategies of the species in the study area.

Relative Frequency of Citation (RFC):

The Relative Frequency of Citation (RFC) index is utilized to gauge the relative importance of a species by analyzing the number of times it is cited by informants. The relative importance of a particular plant species was assessed by calculating the RFC through a defined formula. This quantitative measure allowed for the determination of the species' prominence based on the frequency of citations it received in the ethnobotanical data analysis:

RFC = F_C/N (Tardio and Pardo-de-Santayana, 2008)

Where F_C is the number of informants who mentioned a particular species and N is the total number of informants.

Use Value (UV):

This value evaluates the relative importance of a species identified locally, which is determined by the relation (Tardio and Pardo-de-Santayana, 2008):

$$UV = \sum Ui \backslash N$$

Where Ui represents the number of uses reported by individual informants for a specific plant species, while N denotes the total count of informants.

Fidelity Level (FL):

The Fidelity Level (FL) is a quantitative index employed to assess the relative therapeutic efficacy of a plant species concerning a specific ailment. It serves as a measure of the plant's healing potential, allowing for comparative evaluations of different species based on their fidelity or faithfulness to treating a particular health condition. This index is calculated using the formula:

FL= Ns/N x 100 (Ali-Shtayeh *et al.*, 2000)

Where Ns is the frequency of citation of a particular plant species for a specific ailment category, and N is the total number of citations of that species.

Informant Consensus Factor (ICF):

This was computed to assess the consensus among respondents concerning the utilization of medicinal plants for specific ailments. . This factor serves as a quantitative measure to determine the level of agreement among informants regarding the reported plant species used for treating a particular ailment. The ICF facilitates the identification of commonly agreed-upon medicinal plants within a given community or population. The ICF index is useful in evaluating the knowledge and agreement of the local community on the use of specific plants for medicinal purposes. The ICF index was calculated using the formula proposed by Garedew and Abebe in 2018:

$$ICF = (n_{ur} - n_t) / n_{ur} - 1$$

Where n_{ur} represents the total number of mentions reported for a specific disorder and n_t denotes the number of plant species documented to possess curative properties for that ailment.

RESULTS

The GPS coordinates of the locations of the Asteraceae species studied are shown in Table 1 while the representative specimens of the Asteraceae species collected with the voucher numbers and name of collector are shown in Table 2.

Ethnobotanical Study

A total of 118 respondents participated in the survey, with 65 being male and 53 being female. There were 17 respondents in the age range of 13-35 years; 25 people between 36-50 years; 43 people between 51-65 years, and 33 people were 65 years and older. 38 respondents graduated from primary school; 55 people are secondary school graduates; 12 people have tertiary education and 13 have no formal education. Occupation of the respondents ranged from 27 Traders, 7 Local Healers, 23 Herb Sellers, 24 Farmers, 7 Academic Staff to 30 respondents who are not into any form of occupation. Table 3 provides the demographic profile of the respondents who participated in the interviews.

Table 1: GPS Coordinates and Locations of the Asteraceae Species Studied

S/N	Plant Species	GPS Coordinates	Locations
1.	*Acanthospermum hispidum*	7º32'32"N 4º32'27"E	O.A.U. Teaching and Research Farm, O.A.U., Ile Ife.
		7º29'15"N 4º3 2'0"E	Beside Country Kitchen, Modakeke road, Ile Ife.
		7º29'53"N 4º31'13"E	Aserifa, Ibadan Road, Ile Ife.
2.	*Aspilia africana*	7º30'57"N 4º31'44"E	Back of Natural History Museum, O.A.U., Ile Ife.
		7º32'8"N 4º32'2"E	O.A.U. Teaching and Research Farm gate, O.A.U., Ile Ife.
		7º29'53"N 4º31'22"E	Along O.A.U. campus gate, Ile Ife.
3.	*Ageratum conyzoides*	7º31'7"N 4º31'26"E	Behind Department of English andLiterary studies, O.A.U., Ile Ife.
		7º31'14"N 4º31'18"E	Faculty of Administration basement, O.A.U., Ile Ife.
		7º31'13"N 4º31'18"E	Front of Geology department, O.A.U., Ile Ife.
4.	*Ageratum houstonianum*	7º31'7"N 4º31'42"E	Behind Chemical Engineering Lecture Theatre, O.A.U., Ile Ife.
		7º29'15"N 4º32'0"E	Beside Country Kitchen, Modakeke Road, Ile Ife.
		7º29'53"N 4º31'13"E	Aserifa, Ibadan Road, Ile Ife.
5.	*Acmella radicans*	7º3'9"N 4º31'23"E	Front of Hezekiah Oluwasanmi Library, O.A.U., Ile Ife.
		7º31'10"N 4º31'2"E	Open field in front of Hezekiah Oluwasanmi Library basement, O.A.U., Ile Ife.
		7º31'8"N 4º31'35"E	Botany Department, O.A.U., Ile Ife.
6.	*Blumea perrottetiana*	7º30'58"N 4º31'35"E	Back of Pharmacy department.O.A.U., Ile Ife.
		7º29'53"N 4º31'13"E	Aserifa, Ibadan road, Ile Ife.
		7º32'58"N 4º31'33"E	Behind Faculty of Environmental and Design Management, O.A.U., Ile Ife.
7.	*Bidens pilosa*	7º31'15"N 4º31'0"E	Front of Health centre. O.A.U. campus.
		7º30'57"N 4º31'44"E	Back of Natural History Museum, O.A.U., Ile Ife.
		7º29'53"N 4º31'22"E	O.A.U. campus gate, Ile Ife.
8.	*Eclipta alba*	7º30'58"N 4º31'39"E	Front of Faculty of Pharmacy screen house, O.A.U., Ile Ife.
		7º29'23"N 4º31'56"E	Opposite Ori Olokun roundabout, Mayfair, Ile Ife.
		7º29'22"N 4º31'57"E	Opposite Bofat filling station, Mayfair, Ile Ife.
9.	*Eleutheranthera ruderalis*	7º30'57"N 4º31'39"E	Front of Faculty of Pharmacy screen house, O.A.U., Ile Ife.
		7º30'57"N 4º31'44"E	Beside Natural History Museum, O.A.U., Ile Ife.
		7º31'7"N 4º31'26"E	Behind Department of English and Literary Studies, O.A.U., Ile Ife.
10.	*Emilia praetermissa*	7º31'7"N 4º31'26"E	Behind Department of English and Literary Studies, O.A.U., Ile Ife.
		7º31'8"N 4º31'24"E	Beside Senate building, O.A.U., Ile Ife.
		7º31'15"N 4º31'0"E	Front of Health Centre, O.A. U., Ile Ife.
11.	*Emilia sonchifolia*	7º31'7"N 4º31'26"E	Behind Department of English and Literary Studies, O.A.U., Ile Ife.
		7º31'9"N 4º31'24"E	Front of Humanities building 1, O.A.U., Ile Ife.
		7º31'3"N 4º31'34"E	Beside College of Health Sciences, O.A.U., Ile Ife.
12.	*Chromolaena odorata*	7º31'9"N 4º31'23"E	Front of Hezekiah Oluwasanmi Library, O.A.U., Ile Ife.
		7º31'10"N 4º31'2"E	Hezekiah Oluwasanmi Library basement, O.A.U., Ile Ife.
		7º31'0"N 4º31'39"E	Front of Faculty of Pharmacy, O.A.U., Ile Ife.

Table 1 Continued: GPS Coordinates and Locations of the Asteraceae Species Studied

S/N	Plant Species	GPS Coordinates	Locations
13.	*Crassocephalum crepidioides*	7º30'58"N 4º31'35"E	Back of Faculty of Pharmacy department, O.A.U., Ile Ife.
		7º30'57"N 4º31'44"E	Behind Natural History Museum, O.A.U., Ile Ife.
		7º29'53"N 4º31'13"E	Aserifa, Ibadan Road, Ile Ife.
14.	*Launaea taraxacifolia*	7º31'14"N 4º31'18"E	Faculty of Administration basement, O.A.U., Ile Ife.
		7º30'58"N 4º31'39"E	Beside Faculty of Pharmacy screen house, O.A.U., Ile Ife.
		7º29'22"N 4º31'57"E	Ori Olokun roundabout, Mayfair, Ile Ife.
15.	*Melanthera scandens*	7º32'28"N 4º32'20"E	O.A.U. Teaching and Research Farm, O.A.U., Ile Ife.
		7º31'8"N 4º31'39"E	Beside Chemical Engineering lecture theatre, O.A.U., Ile Ife.
		7º32'32"N 4º32'37"E	O.A.U. Teaching and Research Farm, O.A.U., Ile Ife.
16.	*Synedrella nodiflora*	7º3'9"N 4º31'23"E	Front of Hezekiah Oluwasanmi Library, O.A.U., Ile Ife.
		7º31'10"N 4º31'2"E	Hezekiah Oluwasanmi Library basement, O.A.U., Ile Ife.
		7º31'12"N 4º31'2"E	Beside Moremi hall of residence, O.A.U., Ile Ife.
17.	*Tagetes erecta*	7º31'19"N 4º31'12"E	Modomo area, Ede road Ile, Ife
		7º31'32"N 4º31'18"E	Modomo area, Ede road, Ile Ife
		7º29'53"N 4º31'53"E	Aserifa, Ibadan Road, Ile Ife
18.	*Tithonia diversifolia*	7º 31'8"N 4º32'14"E	O.A.U. Teaching and Research Farm, O.A.U., Ile Ife.
		7º29'49"N 4º31'20"E	O.A.U. campus gate, Ile Ife.
		7º29'23"N 4º31'22"E	Along O.A.U. Campus gate road, Ile Ife.
19.	*Tridax Procumbens*	7º30'57"N 4º31'44"E	Beside Natural History Museum, O.A.U., Ile Ife.
		7º31'8"N 4º31'24"E	Beside Senate Building, O.A.U., Ile Ife.
		7º31'9"N 4º31'24"E	Front of Humanities Building 1, O.A.U., Ile Ife.
20.	*Vernonia cinerea*	7º31'9"N 4º31'23"E	Front of Hezekiah Oluwasanmi Library, O.A.U., Ile Ife.
		7º31'8"N 4º31'24"E	Beside Senate Building, O.A.U., Ile Ife.
		7º31'24"N 4º31'0"E	Front of Health Centre, O.A.U., Ile Ife.

Table 2: Representative Specimens Examined in the IFE Herbarium

S/N	Species	Voucher Specimen Number	Collector
1.	*Acanthospermum hispidum*	IFE 18050	Odelade Esther T.
2.	*Acmella radicans*	IFE 18051	Odelade Esther T.
3.	*Ageratum conyzoides*	IFE 18052	Odelade Esther T.
4.	*Ageratum houstonianum*	IFE 18070	Odelade Esther T.
5.	*Aspilia africana*	IFE 18053	Odelade Esther T.
6.	*Blumea perrottetiana*	IFE 18054	Odelade Esther T.
7.	*Bidens pilosa*	IFE 18055	Odelade Esther T.
8.	*Chromolaena odorata*	IFE 18061	Odelade Esther T.
9.	*Crassocephalum crepidioides*	IFE 18060	Odelade Esther T.
10.	*Eclipta alba*	IFE 18056	Odelade Esther T.
11.	*Eleutheranthera ruderalis*	IFE 18057	Odelade Esther T.
12.	*Emilia praetermissa*	IFE 18058	Odelade Esther T.
13.	*Emilia sonchifolia*	IFE 18059	Odelade Esther T.
14.	*Launaea taraxacifolia*	IFE 18062	Odelade Esther T.
15.	*Melanthera scandens*	IFE 18063	Odelade Esther T.
16.	*Synedrella nodiflora*	IFE 18064	Odelade Esther T.
17.	*Tagetes erecta*	IFE 18065	Odelade Esther T.
18.	*Tithonia diversifolia*	IFE 18066	Odelade Esther T.
19.	*Tridax procumbens*	IFE 18067	Odelade Esther T.
20.	*Vernonia cinerea*	IFE 18068	Odelade Esther T.

Table 3: Demographic Profile of the Respondents Who Took Part in the Ethnobotanical Survey.

S/N	Variables	Category	Key Informants	General Informants	Total	Frequency (%)
1.	Age range	13-35 years	7	10	17	14.41
		36-50 years	10	15	25	21.19
		51-65 years	15	28	43	36.44
		65 years and above	13	20	33	27.97
2.	Gender	Male	28	37	65	55.08
		Female	23	30	53	44.92
3.	Level of Education	None	5	8	13	11.02
		Primary Level	15	23	38	33.20
		Secondary Level	20	35	55	46.61
		Tertiary Level	02	10	12	10.17
4.	Occupation	Trader	09	18	27	22.88
		Local healer	02	05	07	05.93
		Herb seller	08	15	23	19.59
		Farmer	09	15	24	20.34
		Academic staff	02	05	07	05.93
		Others	10	20	30	25.42

Ethnobotanical Information

Ethnobotanical information on the selected species studied, including botanical/scientific name, local/common name, life forms, uses, and plant part(s) used is presented on Table 4. This information may be useful in understanding the traditional knowledge and cultural usages of these plant species in the research area.

Data on the local names of these plants, parts used, traditional uses and modes of application were recorded. Among the species studied, 16 are wild and 4 are either wild or cultivated. These four cultivated species, which include *Crassocephalum crepidioides*, *Emilia praetermissa*, *Launaea taraxacifolia* and *Tagetes erecta*, could also be found growing in the wild. Most of the species were recorded to be used for more than one purpose.

Among the selected and recorded species, *Ageratum conyzoides, Aspilia africana, Bidens pilosa, Chromolaena odorata, Crassocephalum crepidioides, Emilia praetermissa, Launaea taraxacifolia, Melanthera scandens, Vernonia cinerea, Tridax procumbens* and *Tithonia diversifolia*, are the most popular plants with varieties of ethnobotanical uses.

Table 4: Ethnobotanical Information of the 20 Species of Asteraceae Studied

S/N	Plant's Scientific Name	Plant's Local Name	Plant Habit	Cultivation Status	Uses	Part(s) Used	Route of Application	Mode of Preparation
1.	*Acanthospermum hispidum* D.C.	Dagunro gogoro	Herb	Wild	Treatment of malaria; anti-venom for snake bite; eaten as vegetable; decoction taken as treatment for bedwetting and bedridden people; decoction/juice taken as blood tonic; treatment of cough, convulsion, headache, abdominal/stomach pain.	Leaves Entire plant	Oral Topical	Decoction Infusion Juice
2.	*Acmella radicans* (Jacq.) R.K.Jansen		Herb	Wild	Treatment of dysentery; dressing of wounds; flower used as remedy for stuttering children; relieves toothache; decoction is used to bathe as treatment for rheumatism.	Leaves Flowers	Oral Topical	Decoction Infusion Leaf paste Juice
3.	*Ageratum conyzoides* L.	Imi eesu; Apasa; Awogba arun	Herb	Wild	Juice mixed with palm oil and taken to reduce high blood pressure; juice rubbed on the forehead to relieve headache; fodder for livestock; treatment of malaria; juice is rubbed on the skin to cure infections such as rashes, ringworm, eczema; applied on fresh cuts/wounds to stop bleeding and facilitate healing and blood clotting; juice is mixed with salt and drank to treat insomnia; juice mixed with palm oil is rubbed on the body to relieve hot body temperature.	Leaves Entire plant	Oral Topical	Decoction Infusion Leaf paste Juice
4.	*Ageratum houstonianum* Mill.		Herb	Wild	Ornamental; used as insecticide/ pesticide; leaf paste applied on fresh wounds to stop bleeding.	Leaves Entire plant	Topical	Leaf paste Other
5.	*Aspilia africana* (Pers.) C.D. Adams	Yunriyun; Molaganran	Herb	Wild	Decoction used to treat malaria fever; juice applied on fresh cuts/wounds to stop bleeding and speed up healing; decoction drank as cure for malaria; used as a traditional contraceptive by women; used to treat stomach disorder; fodder for livestock.	Leaves Entire plant	Oral Topical	Decoction Infusion Leaf paste Juice Other
6.	*Blumea perrottetiana* DC.	Aruntaba	Herb	Wild	Infusion/juice is taken to treat diarrhea; anti-venom for snake/scorpion bite; juice mixed with fanta is used as cure for typhoid; cure for measles; plant could be dried and mixed with potash which is then added to the soil as fertilizer; bark is made into powder and mixed with milk to treat pile.	Leaves Entire plant	Oral Topical	Infusion Juice Decoction Other

Table 4 Continued: Ethnobotanical Information of the 20 Species of Asteraceae Studied

S/N	Plant's Scientific Name	Plant's Local Name	Plant Habit	Cultivation Status	Uses	Part(s) Used	Route of Application	Mode of Preparation
7.	*Bidens pilosa* L.	Abere oloko; Aganranmoyan; Kegunmaso; Olopa igbo	Herb	Wild	Decoction is prepared as a remedy for measles and high blood pressure; plant is utilized in the treatment of ulcers; plant's juice with palm oil is applied topically to alleviate high body temperature; leaves cooked with sodium bicarbonate and drank to cure typhoid; juice mixed with baby soap for teething; treatment of diabetes, dysentery, jaundice; eaten as vegetable.	Leaves Entire plant	Oral Topical	Decoction Infusion Juice Other
8.	*Chromolaena odorata* (L.) R.M.King & H.Rob.	Ewe Akintola; Ewe Awolowo	Herb Shrub	Wild	Decoction taken as cure for typhoid; decoction, in addition to some other plants, is bathed with and drank for the treatment of malaria; leaf paste applied on fresh wounds/cuts/sores to stop bleeding and accelerate healing.	Leaves Entire plant	Oral Topical	Decoction Leaf paste
9.	*Crassocephalum crepidioides* (Benth.) S.Moore	Ebolo	Herb	Cultivated Wild	Leaves eaten as vegetable; juice taken as blood tonic; decoction taken to enhance sleep; juice mixed with snail water to be drank as treatment for high blood pressure; infusion reduces high blood pressure, dizziness and insomnia; juice applied on fresh wounds to stop bleeding; treats indigestion, stomach aches.	Leaves Entire plant	Oral Topical	Decoction Infusion Juice
10.	*Eclipta alba (L.) Hassk*	Arojokun	Herb	Wild	Treatment of convulsion; juice applied externally to clear eczema, rashes; anti-venom for snake and scorpion bites; serves as cure against epilepsy; used as treatment for hair loss and aids rapid hair growth.		Oral Topical	Decoction Infusion Juice
11.	*Eleutheranthera ruderalis (Sw.) Sch.Bip.*		Herb	Wild	Paste made from the leaves is topically applied to fresh wounds or cuts to promote hemostasis and halt bleeding; an infusion from the plant is ingested as a treatment to reduce high blood pressure; decoction taken with stout to enhance milk production in nursing/lactating mothers.		Oral Topical	Decoction Leaf paste Infusion

Table 4 Continued: Ethnobotanical Information of the 20 Species of Asteraceae Studied

S/N	Plant's Scientific Name	Plant's Local Name	Plant Habit	Cultivation Status	Uses	Part(s) Used	Route of Application	Mode of Preparation
12.	*Emilia praetermissa* Milne-Redh.	Odundun odo	Herb	Cultivated Wild	Plant eaten as vegetable; juice applied externally to treat sores; used to treat eye problems; powdered leaves mixed with shea butter is used for pain relief; decoction taken to treat diabetes and for ease of delivery for pregnant women.	Leaves Entire plant	Oral Topical	Decoction Powder Juice Other
13.	*Emilia sonchifolia* (L.) DC. ex Wight		Herb	Wild	Decoction treats epilepsy in children; treats diarrhea, fever, sore throat; juice rubbed on the body to clear rashes; leaves rubbed on the forehead to relieve headache.	Leaves Entire plant	Oral Topical	Decoction Juice Infusion
14.	*Launaea taraxacifolia* (Willd.) Amin ex C. Jeffrey	Efo yanrin	Herb	Cultivated Wild	Leaves soaked and infusion drank to reduce high blood pressure; eaten as vegetable; used as treatment for ulcer; decoction is taken as antidote for food poisoning; decoction taken as cure for insomnia and cough; juice drank and rubbed on the body as cure for measles; leaves used as salad; serves as a purgative and antimalarial decoction/infusion/ juice taken as treatment for diabetes; juice mixed with local black bathing soap to cure infections.	Leaves Entire plant	Oral Topical	Decoction Infusion Juice Other
15.	*Melanthera scandens* (Schum. & Thonn.) Roberty	Agbigbo; Aboyunriyun; Iyunyun	Herb	Wild	Juice mixed with dry gin as antidote for poisoning; decoction/infusion is used to treat cough, pile, stomach ache, dysentery; decoction/juice is taken to ease child delivery; decoction is used to bathe children as treatment for malaria; leaves boiled with sodium bicarbonate and drank for 3 days treats high blood pressure; fodder for rabbits; leaf paste applied on fresh cuts/wounds to stop bleeding and facilitate healing.	Leaves Entire plant	Oral Topical	Decoction Infusion Juice Leaf paste Other

Table 4 Continued: Ethnobotanical Information of the 20 Species of Asteraceae Studied

S/N	Plant's Scientific Name	Plant's Local Name	Plant Habit	Cultivation Status	Uses	Part(s) Used	Route of Application	Mode of Preparation
16.	*Synedrella nodiflora* (L.) Gaertn.	Apawofa; Tanaposo	Herb	Wild	Juice applied on sores/wounds/cuts to stop bleeding; treatment of headache; fodder for livestock; infusion used to relieve stomach pain/ache.	Leaves Entire plant	Oral Topical	Infusion Juice Other
17.	*Tagetes erecta* L.		Herb Shrub	Wild Cultivated	Ornamental; juice applied externally to treat eczema; decoction/infusion relieves constipation, pile; juice is applied on boils.	Leaves Flowers Entire plant	Oral Topical	Decoction Infusion Juice Other
18.	*Tithonia diversifolia* (Hemsl.) A.Gray	Sepeleba; Korobijogbo	Herb Shrub	Wild	Decoction is used for treatment of malaria; infusion can be used to bathe to lower body temperature; juice is used to treat wounds/bruises; decoction is used to relieve stomach pains, indigestion; leaf paste applied externally on bruises/cuts/wounds to stop bleeding.	Leaves Entire plant	Oral Topical	Decoction Infusion Juice Leaf paste
19.	*Tridax procumbens* L.	Adegbile; Kodeleyiri; Igbalode	Herb	Wild	Juice is drunk every morning as cure for ulcer; juice/powder mixed with shea butter to be rubbed on boils; leaves used as fodder for rabbits; decoction taken as treatment to reduce high blood pressure; used as check for erosion; decoction taken as treatment for ulcer; juice applied on cuts/bruises/wounds to stop bleeding; decoction/infusion drank to treat dysentery, diarrhea, catarrh.	Leaves Entire plant	Oral Topical	Decoction Infusion Juice Other
20.	*Vernonia cinerea* (L.) Less.	Bojure	Herb	Wild	Decoction, in addition to some other plant, is taken as treatment for pile, malaria; infusion taken as blood tonic; juice rubbed on the skin to clear off eczema; juice is drank to treat dysentery, relieve stomach pain and to expel stomach worms; flowers boiled and decoction taken as treatment for fever; cooked with beans to cure ulcer; seeds eaten to cure cough.	Leaves Flowers Seeds Entire plant	Oral Topical	Decoction Infusion Juice

Relative Frequency of Citation (RFC), Use Value (UV), Fidelity Level (FL) and Informant Consensus Factor (ICF) of the 20 Asteraceae Species Studied.

The Relative Frequency of Citation (RFC) is a measure of the relative significance of plant species based on the number of informants who report their usage. In this particular survey, the RFC values ranged from 0.08 to 0.68, with the highest value recorded for *Ageratum conyzoides* at 0.68. This finding highlights the perceived importance of *Ageratum conyzoides* among the surveyed population in comparison to other plant species.

The Use Value (UV) metric quantifies the relative significance of plant species based on the number of reported uses for each species. This metric provides valuable insights into the importance and versatility of plant species in fulfilling various needs. In this work, use values ranged from 0.03 to 0.10. The highest use value was recorded for *Ageratum conyzoides* (0.10) and *Launaea taraxacifolia* (0.10). For these species, 80 informants reported 12 different traditional uses for *Ageratum conyzoides* while 65 informants reported 12 traditional uses for *Launaea taraxacifolia*.

Fidelity level was evaluated based on the number of times a species was cited by an informant to be used as cure for an ailment category. FL values ranged from 55.60 to 91.70 with *Aspilia africana* having the highest FL value. Many uses were reported for *Aspilia africana* by the respondents, but the commonly mentioned uses are treatment of malaria and application on fresh cuts/wounds/sores to stop bleeding and facilitate healing. High FL values were also recorded for *Tithonia diversifolia* (90.70), *Ageratum conyzoides* (90), *Tridax procumbens* (88.60), *Chromolaena odorata* (88.24), *Bidens pilosa* (86.54), *Launaea taraxacifolia* (86.20), *Crassocephalum crepidioides* (84.62), *Emilia praetermissa* (83.33) and *Melanthera scandens* (82.80)

This study reported a total of 14 ailment categories. The ailment categories with the highest use reports are categories of plants used for infections/infestations (97 citations, 11 species), digestive system disorders (92 citations, 11 species), respiratory system disorders (92 citations, 6 species) and injuries (90 citations, 12 species); these use categories all have high ICF values greater than 0.85. The highest value of ICF (0.96) was found in ailment categories of snake/scorpion bites and musculoskeletal system disorders, followed by sleep disorder and respiratory system disorders ailment categories, each having ICF = 0.95 value. The least ICF value was found for pain ailment category (ICF = 0.87).

Table 5: Relative Frequency of Citation, Use Value and Fidelity Level of the 20 species of Asteraceae studied

S/N	Plant Species	RFC	UV	FL
1.	*Acanthospermum hispidum*	0.25	0.08	73.33
2.	*Acmella radicans*	0.15	0.04	55.60
3.	*Ageratum conyzoides*	0.68	0.10	90.00
4.	*Ageratum houstonianum*	0.08	0.03	60.00
5.	*Aspilia africana*	0.61	0.06	91.70
6.	*Blumea perrottetiana*	0.21	0.05	72.00
7.	*Bidens pilosa*	0.44	0.08	86.54
8.	*Chromolaena odorata*	0.58	0.03	88.24
9.	*Crassocephalum crepidioides*	0.55	0.08	84.62
10.	*Eclipta alba*	0.25	0.06	66.70
11.	*Eleutheranthera ruderalis*	0.21	0.03	64.00
12.	*Emilia praetermissa*	0.41	0.05	83.33
13.	*Emilia sonchifolia*	0.19	0.05	72.73
14.	*Launaea taraxacifolia*	0.55	0.10	86.20
15.	*Melanthera scandens*	0.49	0.09	82.80
16.	*Synedrella nodiflora*	0.25	0.03	70.00
17.	*Tagetes erecta*	0.13	0.05	66.70
18.	*Tithonia diversifolia*	0.64	0.05	90.70
19.	*Tridax procumbens*	0.59	0.08	88.60
20.	*Vernonia cinerea*	0.47	0.08	76.40

Table 6: Informant consensus factor (ICF) values for the different ailment categories

S/N	Ailment Categories	Number of Citations for each Ailment category	Number of Species Reported	Informant Consensus Factor
1.	Skin and Subcutaneous Tissues Diseases	80	07	0.92
2.	Respiratory System Infections	92	06	0.95
3.	Nervous System/Neurological Disorders	60	05	0.93
4.	Pain	85	12	0.87
5.	Digestive System Disorders	93	11	0.89
6.	Sleep Disorder	50	03	0.96
7.	Endocrinal System Disorder	60	05	0.93
8.	Blood System Disorders	63	07	0.90
9.	Musculoskeletal Disorders	68	04	0.96
10.	Infections/Infestations	97	11	0.90
11.	Abnormalities	68	08	0.90
12.	Injuries	90	12	0.88
13.	Snake/Scorpion Bites	40	03	0.95
14.	Poisoning	28	02	0.93

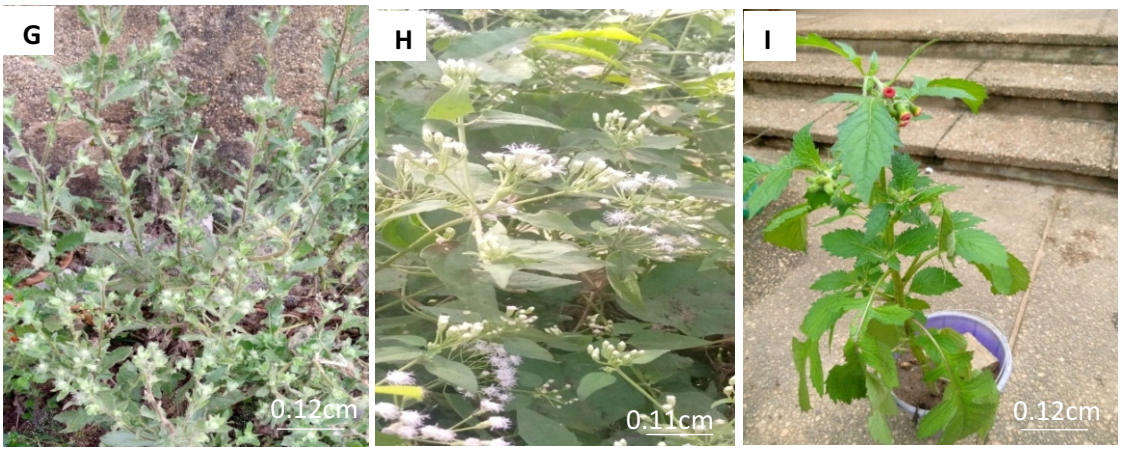

Plate 1: Pictures showing the habits and inflorescences of the Asteraceae Species studied
A – *Acanthospermum hispidum*; B – *Acmella radicans*; C – *Ageratum conyzoides*; D – *Ageratum houstonianum*; E – *Aspilia africana*; F – *Bidens pilosa*; G – *Blumea perrottetiana*; H – *Chromolaena odorata*; I – *Crassocephalum crepidioides*

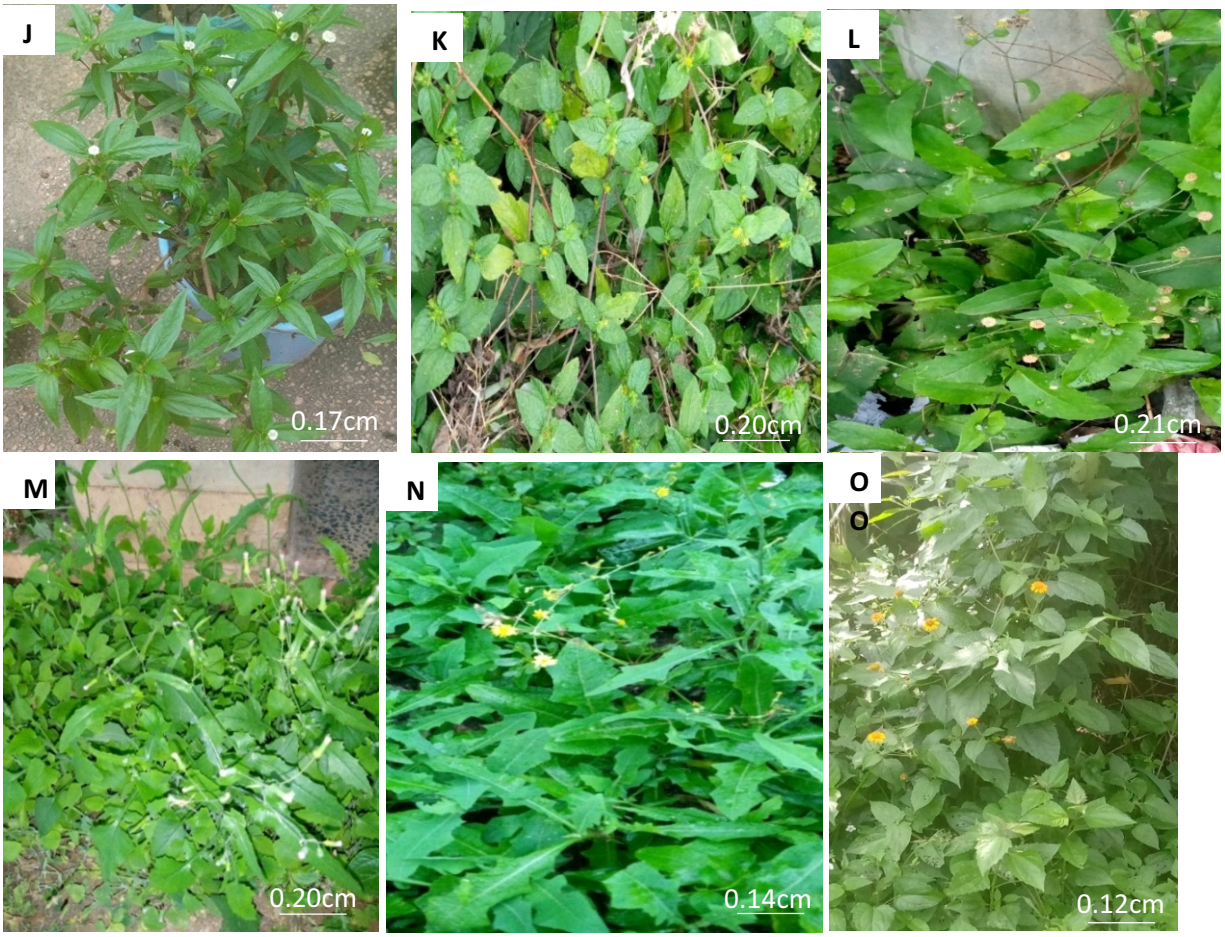

Plate 2: Pictures showing the habits and inflorescences of the Asteraceae species studied
J – *Eclipta alba*; K – *Eleutheranthera ruderalis*; L – *Emilia praetermissa*; M – *Emilia sonchifolia*; N- *Launaea taraxacifolia*; O – *Melanthera scandens*

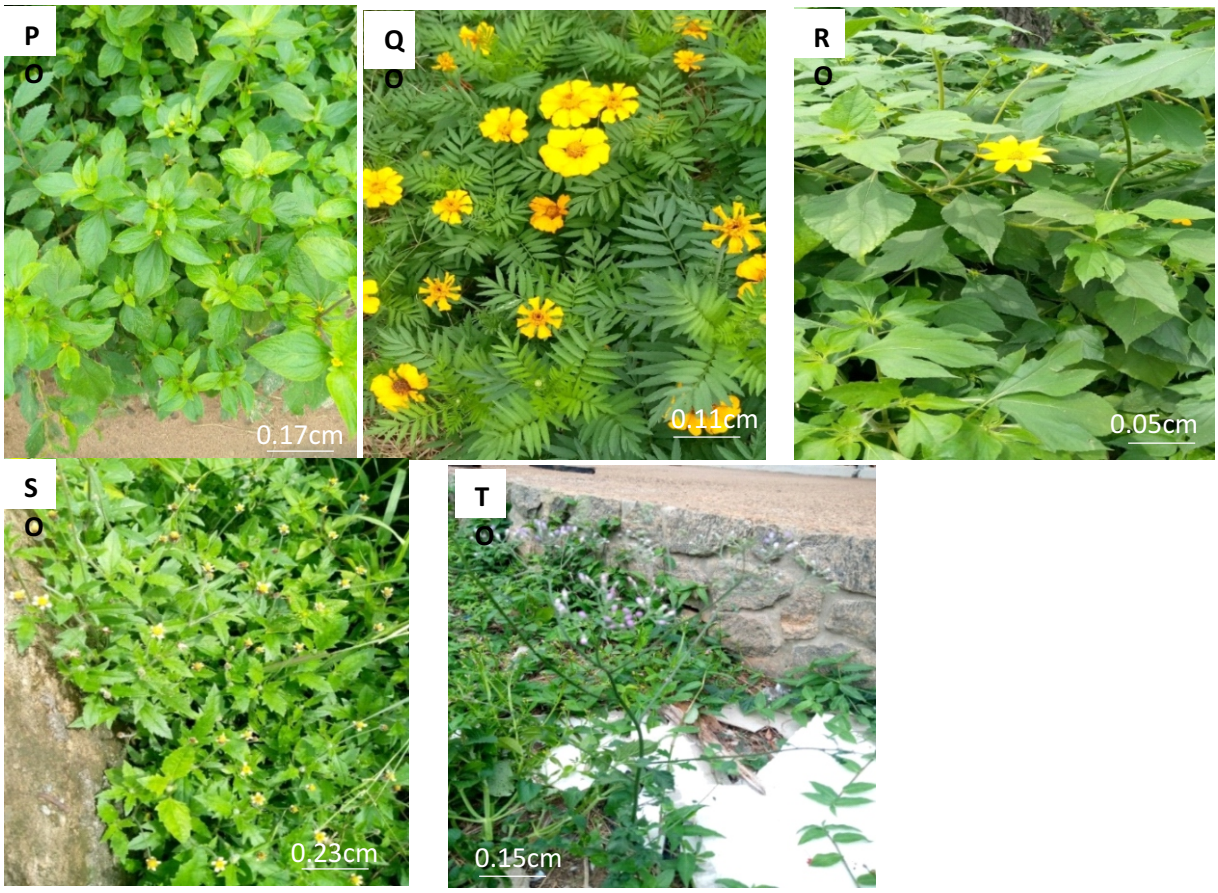

Plate 3: Pictures showing the habits and inflorescences of the Asteraceae species studied
P – *Synedrella nodiflora*; Q – *Tagetes erecta*; R – *Tithonia diversifolia*; S – *Tridax procumbens*; T – *Vernonia cinerea*

Figure 3: Drawings showing biological illustrations of the species studied
A – *Acanthospermum hispidum*
B – *Acmella radicans*
C – *Ageratum conyzoides*
D – *Ageratum houstonianum*
E – *Aspilia africana*
F – *Bidens pilosa*
G – *Blumea perrottetiana*
H – *Chromolaena odorata*
I – *Crassocephalum crepidioides*
J – *Eclipta alba*
K – *Eleutheranthera ruderalis*
L – *Emilia praetermissa*
M – *Emilia sonchifolia*
N – *Launaea taraxacifolia*
O – *Melanthera scandens*
P – *Synedrella nodiflora*
Q – *Tagetes erecta*
R – *Tithonia diversifolia*
S – *Tridax procumbens*
T – *Vernonia cinerea.*
****Each scale bar represents 5mm**

Figure 3: Drawings showing the biological illustrations of the 20 species of Asteraceae studied

DISCUSSION

The Asteraceae family is the most commonly used plant family for medicinal purposes worldwide, according to ethnobotanical meta-analyses (Moerman *et al.,* 1996; Loenti *et al.,* 2003; Saslis-Lagoudakis *et al.,* 2011; Phumthum *et al.,* 2019). Ethnobotanical information was collected on the traditional uses of these plants for asthma, malarial fever, poisoning, eczema, high blood pressure, constipation, diarrhea, diabetes, headache, jaundice, snakebites, skin infections, toothache, wounds/cuts/bruises, worms and others. Ethnobotanical study of the 20 selected Asteraceae plants revealed the traditional uses of these plants. Data collected from the respondents showed that the elderly people (51-65 years) in the study area have adequate knowledge about the plants concerning their uses for both humans and livestock.

The majority of informants rely on traditional healthcare systems that involve the utilization of medicinal plants, either independently or in combination with other substances, such as honey, sodium bicarbonate, milk, beverages, among others. This practice is prevalent and continuous, indicating a deep-rooted belief in the efficacy of traditional medicinal practices in the management of various health conditions. The transmission of plant usage knowledge has traditionally occurred

through oral traditions, transferring wisdom from one generation to the next. However, contemporary elders perceive a decline in the opportunity and inclination of younger generations to acquire this knowledge. They observe a reduced interest and engagement in the intergenerational transfer of plant knowledge. This shift in knowledge transmission patterns among generations is recognized and acknowledged within the academic discourse surrounding plant utilization practices (Kargioglu *et al.,* 2008). The limited transfer of ethnobotanical information can be primarily attributed to the migration of younger families from rural areas, hindering the intergenerational transmission process. This phenomenon of rural out-migration has significant implications for the preservation and continuity of traditional plant knowledge.

Local people use different parts of a plant in the traditional treatment of various ailments, however, the most frequently used parts are the leaves. This agrees with Ugulu *et al.* (2009), who found leaves to be the most commonly used plant part. Indigenous people also use other ingredients, such as honey, palm oil, sodium bicarbonate, snail water, alcoholic drinks, salt, local black soap, to prepare the medicines/treatments. Respondents reported various methods of preparing medicinal remedies using different plant parts. Decoction, infusion, and leaf juice were the three most frequently utilized methods of preparation for treating ailments with plant-based remedies. These findings provide insight into the preferred modes of preparation among the surveyed population for traditional medicinal practices. This supports the findings of Polat (2019) who reported that the two most commonly used modes of preparation in Bingol were infusion and decoction.

As a measure of agreement among participants that a plant or a group of plants can cure a particular ailment category, the importance of ICF should not be underestimated as it serves as a crucial indicator of consensus among participants regarding the medicinal efficacy of specific plants or plant groups in treating a particular category of ailments (Trotter and Logan, 1986). This can be specifically useful in selecting plants for phytochemical and pharmacological studies (Ngoua-Meye-Misso *et al.,* 2019; Asiimwe *et al.,* 2014). This study revealed that the ICF, values ranged from 0.87 to 0.96. The highest value of ICF (0.96) was found in ailment categories of snake/scorpion bites and musculoskeletal system disorders while the least ICF value (0.87) was found in pain ailment category. Informants consensus factor analysis gives a measure of reliability for given claims of evidence (Malla and Chhetri, 2009). Tuttolomondo *et al.* (2014) reported ICF values near 1 for numerous categories, with an average of 0.87 across all categories. This high level of agreement among respondents was attributed to a strong consensus regarding the therapeutic applications and effectiveness of specific plant species.

The average ICF value across all ailment categories in the study was 0.92, indicating a relatively high level of agreement among the respondents regarding the medicinal uses of plant species. This finding suggests a greater level of consensus compared to other studies that have used ICF values to assess the agreement between informants on medicinal plant usage (Heinrich, 2000). The high average ICF value found in the study could potentially be attributed to a limited number of sources for the information provided, resulting in uniformity in the reported uses of medicinal plants among the respondents.

The Relative Frequency of Citation (RFC) was utilized to estimate the local significance of each plant species in the study, with values ranging from 0.08 to 0.68. However, the RFC values may have been influenced by certain plants Launaeae taraxacifolia, Tridax procumbens, Tithonia diversifolia, Emilia Praetermissa, Emilia Sonchifolia, Tagetes erecta being highly valued for purposes other than their medicinal properties. As such, the popularity of some species may not solely reflect their medicinal value, potentially leading to overestimation or underestimation of their importance in traditional medicine (Zenderland *et al.,* 2019). Therefore, it is important to interpret RFC values within the context of the overall cultural significance of the plant species in the community.

Plants with higher RFC values are more popular and recognized by locals (Faruque *et al.,* 2018). In

this study, *Ageratum conyzoides*, *Tithonia diversifolia*, *Aspilia africana*, *Launaea taraxacifolia* and *Tridax procumbens* were the most cited of all the species, hence their high RFC values; *Ageratum houstonianum*, *Acmella radicans*, *Emilia sonchifolia* and *Tagetes erecta* were the least mentioned, hence their low RFC values .

Fidelity Level (FL) is a metric used to determine which plant species are preferred by local populations for treating various ailments (Bouasla and Bouasla, 2017); in this study, FL had values which ranged from 55.60% to 91.70%; *Aspilia africana*, *Tithonia diversifolia* and *Ageratum conyzoides* had the highest FL values while *Acmella radicans* had the lo west. The remedies for frequently reported ailments have the highest FL values while those with low number of reports have lowest FL values. According to Shil *et al.* (2014), higher Fidelity Level (FL) values for a particular plant species indicate its unique efficacy in treating a specific ailment. It is important not to overlook plants with low Fidelity Level (FL) values, as their potential value and significance may be lost, and they could have important implications for future generations (Malik *et al.,* 2018).

Use values for these plant species ranged from 0.03 to 0.10. The species presenting high use values were found to be preferred for at least one use category in the study. However, use values are not static and can change over time due to various factors, such as changes in generational preferences or alterations in patterns of use. As a result, it is possible that use values have decreased for some plant species since the time of the study. It is important to recognize that use values are subject to change and should be continuously monitored in order to gain a comprehensive understanding of the local importance of plant species in traditional medicine (Camou-Guerrero *et al.,* 2008). According to Musa *et al.* (2011), the Use Value (UV) metric lacks the ability to discern whether a plant is utilized for singular or multiple purposes. Plant species that have low Use Value (UV) and/or Fidelity Level (FL) values should not be dismissed as unimportant, as their value may not have been fully realized. However, a low UV value may indicate that traditional knowledge about the plant is not being adequately transmitted, which may result in its gradual loss. It is important to take note of plant species with low use and FL values in order to ensure that their potential value is not overlooked and that they are properly preserved for future generations (Chaudhary *et al.,* 2017). Also, the low use values of some of these plants could be due their scarceness (Benz *et al.,* 1994). This could account for the low use values of *Eleutheranthera ruderalis* and *Ageratum houstonianum* (0.03) as they were scarce in the study area.

CONCLUSION

The ethnobotanical data gathered from this study revealed that Asteraceae plants are hidden wealth of nature; they have several traditional uses which are edible, ornamental and medicinal, and have not been thoroughly and widely explored. The ethnobotanical data will be valuable for ethnomedicinal studies. It was found out that some of the Asteraceae species selected are endangered and decreasing at an alarming rate, and so conservative measures should be put in place before these species go into complete extinction.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

AUTHORS' CONTRIBUTIONS

O.E.T.: Conceptualization, Investigation, Methodology, Formal Analysis, Resources, Data curation, Writing (Original Draft and Review & Editing), Validation, Visualization.

O.O.J.: Resources, Data curation, Supervision, Project administration, Visualization.

A.D.M.: Investigation, Methodology. Resources, Data curation, Visualization.

O.I.I.: Investigation, Methodology, Resources, Data curation, Project administration, Visualization.

F.A.E.: Conceptualization, Methodology, Validation, Resources, Writing (Review &

Editing), Supervision, Project administration, Fund acquisition, Visualization.

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