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A Study on the Checklist of Plants and their Phytochemical Contents from Ugwuto Forest in Nsude, Enugu State

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ABSTRACT

Background and Objective: The plant diversity of the Ugwuto forest is made up of so many forms of plants. The plants range from lower plants such as *Marchantia* to higher plants like *Daniellia oliveri*. The objective of this study was to as certain plant types in the Ugwuto forest and their phytochemical composition. **Materials and Methods:** Quadrat was thrown at the foot and the peak of the forest for the selection of the herbs. The aerial observation was used to select the trees and climbers. A total of 126 plants were collected from the forest while nineteen of these plants were analyzed for different phytochemicals. The Completely Randomized Design was used for this study. **Results:** The plants studied fell under 42 different families. The result of phytochemical analysis of the leaves of the nineteen plants studied revealed that *A. boonei* had the highest composition of the alkaloid (33.900±0.000%), *A. Africana* had the highest percentage composition of saponin (2.207±0.000), steroid content was highest in *A. conyzoides* (2.127±0.006), *M. lucida* had the highest composition of phenol (50.967±0.058) and glycoside was highest in the leaf of *O. celtidifolia* (16.16±0.058). **Conclusion:** All the plants studied are the reservoir of many useful phytochemicals especially alkaloids are at is found in the plants. This suggests that these plants can be used by the pharmaceutical industries for producing drugs that will be effective in the cure of different ailments and disorders.

KEYWORDS

Phytochemical, leaves, alkaloid, species diversity, plants, forest, checklist, Enugu

INTRODUCTION

The importance of plants to man and his environment is indispensables[1]. The plant kingdom represents a great reservoir of biologically active compounds with diverse chemical structures and phytochemicals. These phytochemicals are secondary metabolites that are often present in smaller quantities in higher plants[2]. The specific function of many phytochemicals is still unclear, however, a considerable number of studies have shown that they are involved in the interaction of plants/pests/diseases[3].

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Phytochemical constituents from medicinal plants serve as a source of lead components in drug discovery and design[4]. Some of these chemicals are not only of medicinal value but can also serve man in the field of food supplements, folk neutraceuticals and pharmaceutical intermediates[5]. It has been noted that more than 80% of the world's population depends on plants for their primary health care[6]. According to Weissermel and Arpe[7], endemic plants should be investigated the understand their pharmacological properties and efficacy. According to the survey, it was noted that most modern prescriptions contain plant-derived lead molecules based on drug formation. Despite the medicinal and socio-economic potentials of plant species, they are becoming scarce and thus threatened with extinction[8].

Plants are classified based on taxonomic evidence. This evidence is sourced from many aspects of Botany such as Morphology, Anatomy, Palynology, Embryology, Cytology, Phytochemistry, Ultrastructure, Genome analyses and Nucleic acid hybridization[9].

Plant morphology mainly deals with the external characteristics of the plant such as habits and structures of the root, bud and leaf. Traditional taxonomy considers the morphological character only as useful evidence. It provided the basic language for plant characterization, classification and identification, etc. Morphological data is useful in taxonomic studies[10].

Most of those plants used in the treatment of ailments have not undergone modern scientific research to prove the authenticity of the efficacy of the plants especially those in natural vegetation like the Ugwuto forest. Therefore, it is necessary to subject those medicinal plants to scientific research to know if they have potential elements that can be used to treat ailments that are related to the signatures. This must be done alongside appropriate taxonomic studies of those plants.

This research was conducted to document the plants in the Ugwuto forest and to ascertain their phytochemical components.

MATERIALS AND METHODS

Study area

Ugwuto forest: Ugwuto forest is in Nsude Udi, Enugu, Nigeria, its geographical coordinates are 6°24'0" North, 7°24'0" East. The forest is located at the famous Udi hill. It is close to Enugu/Onitsha express road by the right-hand side from Onitsha to Enugu, in between Ogwofia Owa and 9th Mile Corner Nsude. The elevation of the hill is 456 m above sea level. The base of the forest is filled with main herbs, some shrubs and a few trees, but the vegetation between the base and the peak of the hill is mainly trees and climbers. The peak of the hill is rocky and covered with herbs of different species. The study was carried out at Ugwuto Forest Enugu and the Department of Botany Laboratory, Nnamdi Azikiwe University, Awka from March, 2019 to August, 2021.

Study design: The study design was Complete Randomized Design (CRD). Quadrat was thrown at the foot and the peak of the forest for the selection of the herbs. The aerial observation was used to select the trees and climbers.

Collection of samples and sample preparation: The leaves stem and roots of plant species were collected from the Ugwuto forest, Ugwuto Nsude, Udi Local Government Area, Enugu State Southern Nigeria using Michael *et al.*[11] methods. The voucher specimens were deposited in the Herbarium of the Department of Botany, Nnamdi Azikiwe University, Awka. The leaves that were used were third, the roots were second.

Verification of the checklist of plants in Ugwuto forest: The checklist of the plants in the Ugwuto forest was verified by going around the forest and listing the names of the plants found therein.

Phytochemical composition

Determination of alkaloids: The method of Anukwuorji *et al.*[12], was used for this determination. Five grams of the sample were weighed using an electric weighing balance into a 250 mL beaker. About 100 mL of 10% acetic acid in ethanol was added, covered and allowed to stand for 4 hrs. This was filtered ad the extract was concentrated in a water bath to one-quarter of the original volume. Twenty mL of concentrated ammonium hydroxide was added drop-wise to form a precipitate. The solution was filtered with a weighed filter paper and the precipitate was collected. The filter paper and precipitate were dried in the oven at 40°C. The filter paper was then reweighed and the percentage of alkaloid was calculated[12]:

$$\text{Calculation of alkaloid (\%)} = \frac{W_2 - W_1}{W_3} \times 100$$

Where:
W_1 = Weight of filter paper alone
W_2 = Weight of filter paper residue
W_3 = Weight of the sample used

Determination of saponin: The samples were ground and 10 g of each were put into a conical flask and 100 mL of 20% aqueous ethanol was added. The samples were heated over a hot water bath for 4 hrs with continuous stirring at 55°C. The mixture was filtered and the residue was re-extracted with 100 mL of 20% ethanol. The combined extracts were reduced to 40 mL over a water bath at 90°C. The concentrate was transferred into a 250 mL separating funnel and 20 mL of diethyl ether was added and shaken vigorously. The supernatant (upper layer) was discarded and the purification process was repeated. Exactly 60 mL of n-butanol was added and the bottom and upper layers of the mixture were discarded and recovered respectively. The combined n-butanol extracts were washed twice with 10 mL of 5% aqueous sodium chloride. The lower layer was discarded and the upper layer recovered. The remaining solution was heated in a water bath.

After evaporation, the samples were dried in the oven and the saponin content was calculated thus[13]:

$$\text{Calculation of saponin (\%)} = \frac{W_2 - W_1}{W_3} \times 100$$

Where:
W_1 = Weight of evaporating dish
W_2 = Weight of the dish+sample
W_3 = Weight of sample

Determination of tannins: Five hundred milligrams, 0.5 g of sample was weighed into a 250 mL conical flask and 50 mL distilled water was added. The mixture was shaken for 1 hr on a rotary shaker and was filtered into a conical flask. Five mL of the filtrate was pipetted into a 50 mL volumetric flask and was made up to the mark with distilled water. One hundred milligrams, 0.1 g of tannic acid was dissolved in 100 mL of water to form a tannic solution. Five mL of the solution was pipetted into another 50 mL volumetric flask and made up to the volume. A blank sample was prepared using 5 mL of distilled water.

The three samples were put in an incubator for 1 hr at 30°C. The absorbance was measured at 760 nm[14]:

$$\text{Calculation} = \frac{X - Z}{Y - Z}$$

Where:
X = Extract
Z = Blank
Y = Standard

Determination of glycosides: Ten mL of each extract (of water and ethanol) was pipetted into different boiling tubes. Two mL of DNS, DiNitrosalycylic reagent were added and the tubes were placed into a beaker of boiling water for 10 min. The tubes were then cooled in cold water and 10 mL of distilled water was added. The absorbance was measured at 390 nm wavelength using a spectrophotometer[15].

Calculation:

$$\frac{\text{Concentration} \times \text{volume of sample extracted} = \text{mg/g}}{(5\text{ mL})\text{ volume of cuvette} \times \text{weight of sample used (g)}}$$

RESULTS

Checklist of plants from Ugwuto forest in Nsude: The plants studied fell under 42 different families and they were of various habits, 69 of the plants were trees, 22 were shrubs, 26 were herbs and 8 were climbers (Table 1).

Phytochemical analyses of the leaves: The phytochemical analysis of the leaves of the nineteen plants studied revealed that *A. boonei* had the highest percentage composition of the alkaloid (33.900±0.000^{a}%), *A. Africana* had the highest percentage composition of saponin (2.207±0.000^{a}), steroid content was highest in *A. conyzoides* (2.127±0.006^{a}), *M. lucida* had the highest composition of phenol (50.967±0.058^{a}) and glycoside was highest in the leaf of *O. celtidifolia* (16.16±0.058^{a}). Alkaloid contents of *P. pellucida*, *O. celtidifolia*, *A. africana*, *A. conyzoides*, *S. filicaulis*, *F. elastica*, *C. aralliodes*, *A. boonei*, *D. vellutinum*, *E. coccinea* and *A. repens* had no significant difference among them. *A. ferruginea, P. nitida, G. brevis* and *C. capitatum* had no significant difference. *F. thonningii*, *F. vogelii* and *M. lucida* were among the third group that did not have a significant difference in their alkaloid content (Table 2).

For saponin content of the leaves, there were four groups of plant species that did not have any significant difference among them. The first group included *P. pellucida*, *A. africana*, *F. vogelii*, *F. elastica*, *C. aralliodes*, *A. boonei*, *S. filicaulis* and *E. coccinea*. The second group included *A. ferruginea*, *A. conyzoides*, *A. repens*, *F. thonningii*, *P. nitida*, *D. vellutinum*, *A. repens*, *E. coccinea* and *C. capitatum*. The third group that did not have a significant difference in their saponin contents were *O. celtidifolia*, *C. afer* and *M. lucida*. *Graecoanatolica brevis* had no saponin in its leaves (Table 2).

There were four groups of plant species that have no significant differences in the steroid content of the leaves. The first group included *P. pellucida*, *G. brevis* and *C. capitatum*. The second group included *O. celtidifolia*, *E. coccinea*, *A. boonei*, *P. nitida*, *A. conyzoides*, *S. filicaulis*, *F. elastica*, *A. repens*. In the third group were *F. vogelii*, *C. aralliodes*, *A. ferruginea*, *A. africana*, *M. lucida* and *C. afer*. *Ficus thonningii* and *D. vellutinum* were the members of the fourth group (Table 2).

Table 1: Checklist of plants observed during survey in Ugwuto forest

S/N	Species name	Vernacular name	Family	Habit
1	*Abrus precatorius* Adans	Anya-nnunu	Mimosaceae	Climber
2	*Acanthus momtanus* Anders	Agamevu	Acanthaceae	Herb
3	*Afromomum melegueta* Schum	Oseoji	Zingiberaceae	Herb
4	*Afzelia africana* Kennedy	Akpalata	Ceasalpinaceae	Tree
5	*Afzelia bipindensis* Harms	Aja	Ceasalpinaceae	Tree
6	*Ageratum conyzoides* Linn	Agadinwayiisiawo	Asteraceae	Herb
7	*Albizia adianthifolia* Gull and Per	Avu	Mimosaceae	Tree
8	*Albizia ferruguinea* Welw	Ngwu	Mimosaceae	Tree
10	*Alchonea florinbunda* Coriaria	Mba	Apocynaceae	Tree
11	*Alstonia boonei* Linn	Egbu	Apocynaceae	Tree
12	*Alternenthera repens* Lindl		Amaranthaceae	Herb
13	*Anacardium occidentalis* Chev	Kashu	Anacardiaceae	Tree
14	*Anthonotha macrophylla* Beav	Ububaipa	Ceasalpinaceae	Tree
15	*Antiaris africana* Jussieu	Ojianwu	Moraceae	Tree
16	*Aspilia africana* Lodd	Alamejuna	Asteraceae	Shrub
17	*Azadirachta indica* Lodd	Ogwonnuoria	Meliaceae	Tree
18	*Baphia nitida* Bak	Aboshi	Papilionaceae	Tree
19	*Baphia pubescence* Hook	Aboshi	Papilionaceae	Tree
20	*Berliniacraibiana* Benth	Ububankuru	Ceasalpinaceae	Tree
21	*Bliglia sapida* Konig	Okpucha	Sapindaceae	Shrub
22	*Boerhavia diffusa* Linn	Azu-igwe	Nyctaginaceae	Herb
23	*Boquia angolensis* Ficalho	Oze	Moraceae	Tree
24	*Brachystegia eurycoma* Harms	Achi	Ceasalpinaceae	Tree
25	*Brillantasia nitens* Beav	Ikpereukwuenyi	Brillantaceae	Herb
26	*Bulchhozia coreacea* Engl	Oji-oma	Capparidaceae	Tree
27	*Cassytha filiformis* Linn	Nkogbu-oka	Lauraceae	Climer
28	*Ceiba pentandra* Engl	Akpun'enu	Bombacaceae	Tree
29	*Celtis mildbraedii* Robbbinson	Akpula	Ulmaceae	Tree
30	*Chromolaena odorata* Linn	Obialijeohii	Asteraceae	Herb
31	*Cissus aralioides* Linn	Ugu-ohia	Ampelidaceae	Climber
32	*Cleistopholis patens* Benth	Ojo	Annonaceae	Tree
33	*Clerodendron capitatum* Diels		Verbenaceae	Shrub
34	*Cnetis ferruguinea* D.C.	Utu nkita	Connaraceae	Shrub
35	*Corchorus olitorius* Linn	Ahahaa	Tiliaceae	Herb
36	*Costusafer* Braun	Okwoto	Zingiberaceae	Herb
37	*Cylicodiscus gabunensis* Harms		Mimosaceae	Tree
38	*Dalbergia saxatalis* Linn	Ogundu	Papilionaceae	Shrub
39	*Daniellia oliveri* Rolfe	Agba	Ceasalpinaceae	Tree
40	*Dennetiatripetala* Schumm	Mmimi	Annonaceae	Tree
41	*Desmodium vellutinum* Wild	Obidike	Papilionaceae	Herb
42	*Dialium guineense* Linn	Ukopi	Ceasalpinaceae	Tree
43	*Dichrostachys cinerea* S.W.		Mimosaceae	Tree
44	*Dioscorea dumenterum* Kenth	Ighu	Dioscoreaceae	Climber
45	*Draceana arborea* Link	Ukporoju	Dipterocarpaceae	Tree
46	*Draceanamannai* Bak	Ukporoju	Dipterocarpaceae	Shrub
47	*Diodia scandens* S.W.	Ekwu-eme	Rubiaceae	Herb
47	*Elaeisguinensis* Jacq	Nkwu	Arecaceae	Tree
48	*Eleusine indica* Gaertem	Ichito	Poaceae	Herb
49	*Emilia coccinea* G.Don	Ntiene	Asteraceae	Herb
50	*Emiliasonchifolia* Sims	Ogbunizu	Asteraceae	Herb
51	*Entada abyssinica* Staudex	Agharamiri	Mimosaceae	Tree
52	*Errythropheleumivorense* Chev	Iyi	Ceasalpinaceae	Tree
53	*Erythrina senegalensis* F.T.A	Aja-ezu	Papilionaceae	Tree
54	*Euphorbia heterophylla* Linn	Ogwu-Afo	Euphorbiaceae	Herb
56	*Euphorbia hirta* Lam	Udo-ani	Euphorbiaceae	Herb
57	*Fagara zanthoxyloides* Vahl	Uko	Rutaceae	Tree

Table 1: Continue

S/N	Species name	Vernacular name	Family	Habit
58	*Ficus ovate* Linn	Ogbu	Moraceae	Tree
59	*Ficus benghalensis* Linn	Ogbu-Oku	Moraceae	Tree
60	*Ficus elastica* Linn	Ogbuudele	Moraceae	Tree
61	*Ficus exasperate* Linn	Awuliwa	Moraceae	Tree
62	*Ficus sur* Heckel		Moraceae	Tree
64	*Ficus thonningii* Linn	Ogbunfeewu	Moraceae	Tree
65	*Ficus vogeliana* Linn	Ogbuegbo	Moraceae	Tree
66	*Ficus vogelli* Linn	Ogbu	Moraceae	Tree
67	*Fleuriaaestuants* Burm		Urticaceae	Herb
68	*Garcinia kola* Heckel	Aki ilu	Guttiferae	Tree
69	*Glyphaea brevis* Welw	Ayachu	Tiliaceae	Tree
70	*Gnetum africana* Welw	Ukazi	Gnetaceae	Climber
71	*Gongronema latifolium*	Utazi	Asclepiadaceae	Climber
72	*Harungana madagascariensis* Lam		Hypericaceae	Climber
73	*Hexalobus crispiflorus* Rich	Oji ogada	Annonaceae	Tree
74	*Hirsute portulaca* Staudt		Zingiberaceae	Herb
75	*Hyptis suaveolens* Poit	Ogwu-anwu	Lamiaceae	Herb
76	*Icacina tragachantha* Oliv	Utumo-nkita	Icacinaceae	Shrub
77	*Irvingia gabonensis* Linn		Irvingiaceae	Tree
78	*Kalachoe pinnatum* Lindl	Oda-opue	Caricaceae	Herb
79	*Landolphia dulcis* Linn	Utu	Apocynaceae	Climber
80	*Lantana camara* Lindl		Verbenaceae	Tree
81	*Mangifera indica* G.Don	Mango	Anacardaceae	Tree
82	*Memecylon blakeoides* G.Don	Anya enyi	Melastomataceae	Tree
83	*Milletia aboensis* Hook		Papillionaceae	Tree
84	*Milletia rhodantha* Baker	Nzashi	Papilionaceae	Tree
85	*Milletia thonningii* Arn	Ilo	Papilionaceae	Tree
86	*Millicia excels* Bentham	Oji	Moraceae	Tree
87	*Mondia whitei* Wight	Adoo	Periplocaceae	Climber
88	*Morinda lucida* Bentham	Eze-ogwu	Rubiaceae	Tree
89	*Mucuna flagelibis* Lindl	Agbara	Papilionaceae	Shrub
90	*Napoleona imperalis* P.Beav	Ukpoju	Lecythidaceae	Tree
91	*Nauclea latifolium* Lindl	Ovuluminu	Rubiaceae	Tree
92	*Newbouldia laevis* Beav	Ogirisi	Bignoniaceae	Tree
93	*Opilia celtidifolia* Linn	Akuito	Opiliaceae	Shrub
94	*Palisota hirsute* Schumm	Ikpereukwuaghulu	Commelinaceae	Herb
95	*Parkia bicolour* Linn	Ogiriokpei	Mimosaceae	Tree
96	*Parkia clappertoniana* Linn	Ogiri	Mimosaceae	Tree
97	*Pentaclethra macrophylla* Benth	Ukpaka	Mimosaceae	Tree
98	*Peperomia pellucid* Pav		Piperaceae	Herb
99	*Phyllantus amarus* Schumm	Enyi-kwo-nwa	Euphorbiaceae	Herb
100	*Picralima nitida* Linn	Oseuta	Apocynaceae	Tree
101	*Prosopis africana* Linn	OgiriOkpei	Mimosaceae	Tree
102	*Pterocarpus santalinoides* Harms	Uturukpa	Paipilionaceae	Tree
103	*Rauvolfia vomitoria* Afzel	Akanta	Apocynaceae	Shrub
104	*Ritchiea capparoides* De Wild		Capparidaceae	Shrub
105	*Rothmania nitida* Schumm	Uli	Rubiaceae	Shrub
106	*Securidaca longepedunculata*	Ikeagwunwankpi	Polygalaceae	Tree
107	*Securinega virosa* Schumm		Polygonaceae	Shrub
108	*Sellaria media* Burm	Nri-okuko	Caryophyllaceae	Herb
109	*Senna alata* Roxb	Ogwu-ngwo	Caesalpiniaceae	Shrub
110	*Senna occidentals* Link	Nsigbummuo	Casesalpiniaceae	Shrub
111	*Senna rotundifolia* Lindl		Caesalpinaceae	Shrub
112	*Senna tora* Lindl	Nsigbummuo	Caesalpiniaceae	Herb
113	*Sida acuta* Burm	Otakpo	Malvaceae	Shrub
114	*Spathodea campanulata* Beauv	Imiewu	Bignoniaceae	Shrub

Table 1: Continue

S/N	Species name	Vernacular name	Family	Habit
115	*Spilanthes filicaulis* Welw	Ose ani	Asteraceae	Herb
116	*Spondias cyteria* Lindl		Anacardiaceae	Tree
117	*Staudiastipitata* Warb		Myristicaceae	Tree
118	*Terapleura tetraptera* Taub	Asirisha	Mimosaceae	Tree
119	*Treculia africana* Decne	Ukwa	Moraceae	Tree
120	*Trema guineensis* Linn	Telemukwu	Ulmaceae	Tree
121	*Urena lobata* Linn	Udo	Malvaceae	Shrub
122	*Uvaria chamae* Palisot	Ekpelekawata	Annonaceae	Shrub
123	*Vernonia comfirta* Schreb		Asteraceae	Tree
124	*Voacanga africana* Stapf	Osisi-roba	Apocynaceae	Shrub
125	*Xylopia quintasii* Lindl	Udofia	Annonaceae	Tree
126	*Xylopia vilosa* Lindl	Uda	Annonaceae	Shrub

Table 2: Phytochemical composition of the leaves of all the plants studied

	Percentage composition					
Plant part	Alkaloid	Saponin	Steroid	Tannin	Phenol	Glycoside
Peperomia pellucid	2.177±0.006^{a}	1.047±0.006^{a}	ND	3.603±0.006^{a}	ND	0.1700.010^{b}
Opiliaceltidifolia	1.890±0.017^{a}	1.033±0.006^{c}	1.423±0.006^{a}	0.427±0.006^{b}	0.113±0.006^{b}	16.16±0.058^{a}
Albizia ferruginea	1.027±0.006^{b}	1.143±0.006^{b}	0.907±0.012^{c}	0.160±0.020^{c}	0.063±0.006^{c}	0.063±0.0076^{c}
Aspiliaafricana	6.303±0.006^{a}	2.207±0.006^{a}	0.120±0.010^{c}	0.180±0.001^{b}	0.110±0.010^{c}	10.233±0.115^{a}
Ageratum conyzoides	4.247±0.006^{a}	0.387±0.006^{b}	2.127±0.006^{a}	5.103±0.006^{a}	2.823±0.012^{a}	0.277±0.006^{b}
Spilanthes filicaulis	1.333±0.006^{a}	2.120±0.010^{a}	1.027±0.006^{a}	6.787±0.006^{a}	1.063±0.012^{a}	ND
Ficus thonningii	0.057±0.006^{c}	1.510±0.010^{a}	0.037±0.006^{b}	1.263±0.012^{b}	1.147±0.006^{a}	ND
Ficus vogelli	0.087±0.006^{c}	1.477±0.006^{a}	0.017±0.006^{c}	1.177±0.006^{a}	1.090±0.010^{a}	ND
Ficus elastic	9.057±0.006^{a}	1.390±0.010^{a}	0.027±0.006^{b}	1.137±0.006^{a}	1.110±0.010^{a}	0.057±0.006^{b}
Cissus aralliodes	1.827±0.006^{a}	0.640±0.010^{a}	0.023±0.006^{b}	0.140±0.010^{a}	0.117±0.012^{b}	1.827±0.006^{a}
Morinda lucida	0.200±0.000^{c}	0.397±0.006^{c}	0.013±0.006^{c}	0.177±0.006^{a}	50.967±0.058^{a}	ND
Costusafer	0.770±0.010^{c}	0.317±0.015^{c}	0.033±0.006^{c}	0.287±0.015^{c}	ND	ND
Alstoniaboonei	33.900±0.000^{a}	0.367±0.105^{a}	0.117±0.006^{a}	0.146±0.001^{b}	0.810±0.000^{a}	0.103±0.006^{c}
Desmodium vellutinum	2.133±0.015^{a}	0.317±0.006^{b}	0.133±0.006^{b}	0.110±0.010^{c}	0.027±0.006^{b}	0.120±0.010^{c}
Picralima nitida	0.323±0.006^{b}	0.307±0.006^{b}	0.113±0.006^{a}	0.277±0.006^{b}	0.137±0.006^{c}	ND
Alternenthera repens	0.263±0.012^{a}	0.117±0.006^{b}	0.117±0.006^{b}	0.107±0.006^{b}	0.047±0.015^{b}	0.117±0.012^{c}
Emilia coccinea	1.723±0.012^{a}	0.367±0.012^{b}	0.210±0.010^{a}	0.360±0.010^{b}	1.307±0.006^{a}	0.113±0.113^{b}
Glyphaea brevis	0.177±0.006^{b}	ND	ND	ND	0.107±0.006^{b}	3.417±0.006^{b}
Clerodendron capitatum	0.237±0.012^{b}	0.053±0.006^{b}	ND	0.013±0.006^{c}	ND	0.087±0.006^{b}
p-value	**	**	**	**	**	**

Results in Means±Standard Deviation followed by the same letter are not significantly different at p = 0.05, it is done in rows, ND: Not detected and **Means the level of significance

There were four groups of plants with no significant difference in their tannin percentage composition of the leaves. The first group included *P. pellucida*, *M. lucida*, *C. aralliodes*, *F. elastica*, *S. filicaulis*, *A. conyzoides*, *F. vogelii* and *A. repens*. The second group included *O. celtidifolia*, *A. africana*, *F. thonningii*, *A. boonei*, *A. repens*, *P. nitida* and *E. coccinea*. The third group without a significant difference in their tannin content included *D. vellutinum*, *A. ferruginea*, *C. capitatum* and *C. afer*, *G. brevis* had no tannin (Table 2).

For phenol content of the leaves, there were three groups of plant species that did not have any significant difference among them. The first group included *P. pellucida*, *C. aralliodes* and *C. capitatum E. coccinea*. The second group included *A. repens*, *O. celtidifolia*, *C. afer* and *G. brevis*. *A. ferruginea*, *A. africana* and *P. nitida* were members of the third group. *Desmodium velutinum*, *A. repens* and the fourth group that did not have a significant difference in their saponin contents was *A. conyzoides*, *S. filicaulis*, *F. vogelii*, *F. elastica*, *F. thonningii*, *A. boonei*, *E. coccinea* and *M. lucida* (Table 2).

There were four groups of plants with no significant difference in their glycoside percentage composition of the leaves. The first group included *G. brevis*, *C. capitatum*, *E. coccinea*, *P. pellucida*, *F. elastica*,

A. conyzoides and *A. repens*. The second group included *O. celtidifolia*, *C. aralliodes* and *A. africana*. The third group without significant difference in their glycoside content included *A. boonei*, *A. repens*, *D. vellutinum* and *A. ferruginea*. The fourth group comprises *S. filicaulis*, *F. thonningii*, *F. vogelii*, *P. nitida*, *M. lucida* and *C. afer* (Table 2).

DISCUSSION

The plant diversity of the forest is made up of many forms of plants. The plants range from lower plants such as *Marchantia* to higher plants like *Daniellia oliveri*. The morphological features of *Ficus thonningii*, *Ficus elastic* and *F. vogelli* showed that they had a close relationship. Such features were the presence of white latex, the peppery taste of the leaves and the possession of aerial roots which are features of the genus *Ficus*. The anatomical features such as the absence of leaf hairs, the presence of intercellular spaces in the roots and the presence of deposits in the stem were the same in the members of the genus *Ficus* studied. The leaf epidermises of *Ficus vogelii* and *Ficus thonningii* are multiseriate, showing the similarity of both plants since scientists had earlier said that epidermal nature is of taxonomic significance. *Aspilia africana*, *Ageratum conyzoides* and *Emilia coccinea* which were the members of Asteraceae studied showed similar morphological features such as herbaceous nature and pubescent body as stated by Singh[16].

The statement of Saxena and Saxena[17] that families with all species without tannin include Amaranthaceae and Verbenaceae does not concur with this work, because *A. repens* and *C. capitatum* which belong to the families Amaranthaceae and Verbenaceae respectively have tannin in them as seen in this work. However, the presence of steroids in *P. nitida* confirmed his statement that the family Apocynaceae is known for its steroidal content. Generally, the phytochemical contents of *P. pellucida* which belong to the family Piperaceae were not significantly different from those of *A. africana*, *A. conyzoides* and *E. coccinea* which belong to the family Asteraceae.

The presence of alkaloids, flavonoids, saponins, tannins and cardiac glycosides in *G. brevis* agreed with the findings of Zanatta *et al.*[18]. Tannin was not found in the leaf. Generally, the phytochemical constituents of the plant were minimal. This did not agree with the findings of Zanatta *et al.*[18], who reported a significant quantity of phytochemicals in the leaves. Etuk and Mohammed[19] stated that there was the presence of alkaloids, terpenoids, flavonoids, tannins and active proteins in *F. thonningii*. This finding supported the result of this present work. This present work did not agree with the statement of so many researchers that glycoside is ubiquitous in the entire genus *Ficus*. There was no glycoside in the *F. thonningii* as shown in this present work. The result of the work of Ekor[20] concurs with this work because of the presence of some phytochemicals such as alkaloids, terpenoids and saponins.

The presence of alkaloids and other phytochemicals in various parts of *C. capitatum* is in line with the work of Ruiz-Terán *et al.*[21]. The phytochemical results of *F. vogelii* as stated by Malik *et al.*[22] were in line with the result of this work because there was a presence of alkaloid, flavonoid and other phytochemicals in *F. vogelii*. *Morinda lucida* had some phytochemical constituents that Odoh *et al.*[23], also found in the plant. Such chemicals were alkaloids, tannins and saponins. Alkaloid as found by Bagchi *et al.*[24], is abundant in angiosperms. This work confirmed Bagchi *et al.*[24], statement that alkaloid is abundant in angiosperms. All the plants that were worked on in this work had alkaloids. This work revealed that the leaves of all the plants assayed had alkaloids in various quantities as seen in Table 1. Saponin was found in the leaves of all the plants assayed except that of *G. brevis*.

This study depicted that the Ugwuto forest in Enugu State is a reservoir of plants with rich medicinal phytochemicals. The inference of the study has laid sufficient background for further research on the different species of plants identified in the forest and their phytochemicals substances. No doubt, the study has helped in establishing scientific evidence for the rationality of the traditional use of plants for

curing so many ailments. It is on record that these phytochemicals especially alkaloid that was chiefly detected in most plants in the study area play significant roles in the formulation of drugs that help in strengthening the human immune system, reducing inflammation and preventing the damaged cell from reproducing among so many other benefits.

CONCLUSION

The leaf extracts of the plants in the Ugwuto forest studied showed an abundant production of phytochemicals, especially alkaloid that was present in all the plants as secondary metabolites. The enormous phytochemical constituents of these plants give a basis for their use in traditional medicine to manage ailments and disorders.

SIGNIFICANCE STATEMENT

Plants have contributed significantly to the stability of the earth and the sustenance of life through the production of food and medical substances. It is on this note that this research was conducted to document the plants in the Ugwuto forest and to ascertain their phytochemical components. This study discovers that most plants in the Ugwuto forest are reservoirs of various phytochemicals that can be used by the pharmaceutical industries for producing drugs because of the presence of heavy biological active ingredients. The most common phytochemical detected was alkaloid which is of great importance in the pharmaceutical industry. This justifies the use of these plants in traditional medicine for the treatment and prevention of various diseases that affect humans.

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