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Ethnomedicinal and Phytochemical Profile of Some Savanna Plant Species in Nigeria

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Abstract: A study was conducted to evaluate the usage in trado-medicine and phytochemical profiles of some plants of common occurrence in the Savanna eco-region of Nigeria. The plant species evaluated, included three members from legumes and Liliaceae and one each of the Annonaceae, Burseraceae and Solanaceae. Their acclaimed uses in traditional medicine are as varied as their taxonomic distribution. Phytochemical analyses in acetone revealed that *Entada africana*, *Dichrostachys glomerata*, *Annona senegalensis* and *Boswellia dalzielli* had the highest diversity of phytochemicals (4 classes each), followed by *Piliostigma thonningii*, which had three classes and then *Datura metel*, *Asparagus africana* and *Urginea ultissima* which had two classes. *Aloe barterri* had only one class. In petroleum ether *Annona senegalensis* had the highest diversity of phytochemicals (4 classes) followed by *Datura metel, Entada africana, Piliostigma thonningii* and *Boswellia dalzielli*, which had three each. Each of *Asparagus africana* and *Urginea ultissima* had one class. *Aloe barterii* did not yield any phytochemical. The saponins had the highest frequency of occurrence (100%) followed by alkaloids (66.7%), tannins (57.1%), flavonoids (55.6%), then anthraquinones, sapogenins and terpenes (33.3% each). In petroleum ether, saponins also had the highest frequency of occurrence (88.9%) followed by sapogenins and terpenes (44.4%), tannins and flavonoids (33.3% each), anthraquinones (28.6%) and then alkaloids (0.0%).

Key words: Phytochemistry, Nigeria, medicinal plants

INTRODUCTION

Plants provide a source of medicines, which are useful in treatment of various categories of human ailments and conditions. The World Health Organization (WHO) has estimated that up to 80% of the world's population rely on plants for their primary health care[1], while in Nigeria, a 1985 WHO survey estimated that up to 75% of the population patronize traditional medicine[2].

Traditional medicine has been defined as the sum total of all knowledge and practices whether explicable or not, used in diagnosis, prevention and elimination of physical, mental, social and spiritual imbalance, relying exclusively on practical experiences and observation down from generation to generation[3].

In Nigeria, as indeed in most parts of Africa, indigenous knowledge of traditional medical practices is passed on orally and thus memory plays a very prominent role in the training of a practitioner[4]. Most often, classification of plants used in this medical system is based on some quality or property of the plant, while in other instances; the plants are classified on the basis of their therapeutic value. It may also take into account their odor, texture of leaves, reaction when touched and the sensation felt on contact[2].

The therapeutic value of plants used in trado-medicine derives from the presence of phytochemical principles[5], which are found in parts of the plants such as alkaloids, tannins and phenols etc. These chemical principles vary in distribution within the plant parts, as well as in their occurrence within plant species.

In Nigeria, ethnobotanical surveys of plants used in traditional medicinal practices among the Igede and Tiv speaking people of central Nigeria have been reported[6,7]. Similarly Bako *et al.*[8] reported some ethnobotanical uses of plants of common occurrence in parts of the Guinea and Sudan Savanna regions of Nigeria. Due to expanding focus on the use of traditional/natural medicine, it has become necessary to document the trado-medicinal uses, as well as expand our knowledge of the possible active principles involved in the acclaimed efficacies of plants used in this system.

The purpose of this study was therefore, to evaluate and document the ethno-medicinal and phytochemical profile of some plants used in trado-medicine in the Nigerian savanna.

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Table 1: Acclaimed medicinal uses of some savanna plants in Nigerian trado-medicine

Scientific name/family	Local name (Hausa)	Vegetative growth form	Uses
Aloe barterii (Liliaceae)	Zabuwa	H	Anti-biotic and anti-viral ointments. Weight control remedies
Annona senegalensis (Annonaceae)	Gwandar daji	T	Vermifuge, cures sleeping sickness and arthritis
Aparagus africana (Liliaceae)	Marin kusu	H	Kidney and bladder disorders, dropsy, jaundice gall problems, improves sexual potency, cures syphilis, purgative and laxative
Boswellia dalzielli (Burseraceae)	Hannu	H	Cures for fevers, hypertension, rheumatism
Datura metel (Solanaceae)	Zakami	S	Aphrodisiac, intoxicant, cures bronchial asthma
Dichrostachys cinerea (Leguminosae-Mimosoideae)	Dundu	S	Alleviates impotency, stomach cramps, vermifuge and purgative
Entada africana (Leguminosae-Mimosoideae)	Tawatsa	T	Stomach upset, tonic, arrow poison
Piliostigma thonningii (Leguminosae-Caesalpinioideae)	Kargo	S	Improves health of nursing mothers, alleviates fevers, skin irritations and stomach upsets
Urginea ultissima (Liliaceae)	Albasar gizo	H	Stimulates heart muscle, cures bronchitis, dropsy. An arrow poison

H = Herb; S = Shrub; T = Tree

Table 2: Phytochemical constituents of some savanna plant species as extracted in acetone

Species	Anthraquinones	Alkaloids	Sapogenins/Terpenes	Tanins	Flavonoids	Saponins
Aloe barterii	-	-	-	-	+	-
Annona senegalensis	ND	+	ND	+	+	+
Aparagus africana	+	-	-	-	+	-
Boswellia dalzielli	ND	+	ND	+	+	+
Datura metel	ND	-	+	-	+	-
Dichrostachys cinerea	ND	-	+	+	+	+
Entada africana	ND	+	+	+	+	-
Piliostigma thonningii	ND	-	+	+	+	-
Urginea ultissima	+	-	-	-	+	-

- = Absent, + = Present, ND = Not determined

MATERIALS AND METHODS

The Nigerian savanna is located between latitude 11°11' N and longitude 7°37'E. The area covers more than half of the Nigerian land mass and is populated by a mixture of diverse cultures.

Field surveys and collection of data were conducted between 1997-2000. Information on traditional medical uses of plants was obtained by oral interviews with knowledgeable practitioners.

Plant parts (mainly barks and leaves) were collected from the wild and cleaned. These were then placed in paper envelopes and dried to constant weight at 70°C in an oven.

For all the phytochemicals except alkaloids, warming the powdered plant material in 500 mL of acetone for 6 h, then allowing cooling at room temperature for 24 h did extraction. The extract was then filtered and acetone was recovered. The residue was dried using a vacuum rotary evaporator. The dried mass was then extracted in petroleum ether (40-60°C) for 4 h. Petroleum ether was filtered and the solvent was recovered leaving a greenish mass that was labeled C_1 fraction. The residue that was left after the extraction of the petroleum ether was then dissolved in acetone and was labeled C_2.

The two fractions C_1 and C_2 obtained were subjected to chemical tests.

For alkaloids, 10 g of the plant material were extracted using ethyl alcohol. The resultant extract was evaporated to dryness. To this extract 10% HCl was added and the mixture was shaken for 10 min. This was subsequently filtered and then shaken with chloroform in a separating funnel. The chloroform layer was washed with water and kept over anhydrous sodium sulfate for 12 h. This layer was then filtered off, evaporated to dryness and labeled C_3. This fraction was used for chemical tests.

RESULTS

Out of the 9 plant species evaluated, three were legumes, three belonged to the Liliaceae while one each belonged to Annonaceae, Burseraceae and Solanaceae. Their acclaimed uses in traditional medicine are as varied as their taxonomic distribution within the plant families (Table 1). Their normal growth forms were equally varied, ranging from herbs to shrubs to trees.

Results for the preliminary analyses of phytochemical constituents in acetone revealed that *Entada africana, Dichrostachys glomerata*, *Annona senegalensis* and *Boswellia dalzielli* had the highest diversity of phytochemicals (4 classes each), followed by *Piliostigma thonningii*, which had three classes and then *Datura metel*, *Asparagus africana* and *Urginea ultissima* which had two classes. *Aloe barterri* appeared to have the lowest diversity of phytochemical constituents, having only one class (Saponins)(Table 2).

Annona senegalensis had the highest diversity of phytochemicals (4 classes) followed by *Datura metel,*

Table 3: Phytochemical constituents of some savanna plant species as extracted in petroleum ether

Species	Anthraquinones	Alkaloids	Sapogenins/Terpenes	Tanins	Flavonoids	Saponins
Aloe barterii	-	-	-	-	-	-
Annona senegalensis	ND	+	+	+	+	-
Aparagus africana	-	-	-	-	+	-
Boswellia dalzielli	ND	+	-	+	+	ND
Datura metel	ND	+	+	-	+	-
Dichrostachys cinerea	ND	-	-	-	-	ND
Entada africana	ND	+	+	-	+	-
Piliostigma thonningii	ND	-	-	+	+	+
Urginea ultissima	-	-	-	-	+	-

- = Absent, + = Present, ND = Not determined

Table 4: Frequency of occurrence of some classes of phytochemicals in some savanna plant species as extracted by acetone and petroleum ether

Class	% Occurrence in acetone	% Occurrence in petroleum ether
Alkaloids	66.7	0.0
Sapogenins/Terpenes	33.3	44.4
Tanins	57.1	33.3
Flavonoids	55.6	33.3
Saponins	100.0	88.9
Anthraquinones	33.3	28.6

Entada africana, *Piliostigma thonningii* and *Boswellia dalzielli*, which had three each. Each of *Asparagus africana* and *Urginea ultissima* had one class, while *Aloe barterii* did not yield any phytochemical on extraction with petroleum ether (Table 3).

Upon extraction in acetone, the saponins had the highest frequency of occurrence (100%) followed by alkaloids (66.7%), tannins (57.1%), flavonoids (55.6%), then anthraquinones, sapogenins and terpenes (33.3% each). In petroleum ether, saponins also had the highest frequency of occurrence (88.9%) followed by sapogenins and terpenes (44.4%), tannins and flavonoids (33.3% each), anthraquinones (28.6%) and then alkaloids, which did not appear in any of the species when extracted with this solvent (Table 4).

DISCUSSION

Occurrence of a wide variety of phytochemicals in these widely divergent plant families underscores the importance of these chemical compounds to plants. Phytochemicals are by products of primary metabolic functions of the plant - otherwise called the secondary metabolites[9] They are produced and used by the plants for protection and repair processes within the natural environment. Some (e.g. phenolics) are employed in adaptive/defence mechanisms[10,11]

Man has benefited from the presence of these chemicals by exploiting the plant products as sources of sustenance in a variety of ways, including food and medicine. For example, many drugs today are of plant origin. Pharmacological history is replete with examples such as aspirin, quinine, digitalin, picrotoxin, reserpine etc. In fact, many of the synthetic drugs are fashioned after natural plant products[12].

While this study by no means attempts to provide a comprehensive directory of the diverse use of plants in treatment of the wide variety of diseases, it has highlighted the fact that, such acclaimed efficacies are attributable to the presence of the phytochemicals[4,5]. Effective administration of these plant products must of necessity be left to experienced trado-medical practitioners. This is because, a herbal preparation which is acclaimed to be of therapeutic value when administered in one way or dose, could become lethal if administered in another. For example in this study, *Urginea ultissima*, being acclaimed as a cure for bronchitis, dropsy and as a stimulant of the heart muscle, is also used as an arrow poison. Similarly, *Entada africana* being effective in alleviating stomach troubles and as a tonic is also used as an arrow poison. *Datura metel* is acclaimed to be efficacious in treatment of bronchial asthma and as an aphrodisiac, but it is also an intoxicant and hallucinogen. Intake of high quantities could lead to loss of consciousness or even death.

Saponins and alkaloids appeared most frequently than other compounds when extracted in acetone. However, when extracted in petroleum ether, only saponins appeared with similar regularity, followed by sapogenins and terpenes. This is in line with the fact that saponins and alkaloids are large and diverse groups of compounds, which differ, in chemical properties. Differences in frequency of occurrence could either imply complete absence in the plant part analysed or a differential solubility of the compound in the solvent used.

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