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Research Paper

TAXONOMIC SIGNIFICANCE OF ALKALOIDS AND PHENOLS IN THE SPECIES OF STACHYTARPHETA FOUND IN AWKA, NIGERIA

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Abstract

The alkaloid and phenol content of the three *Stachytarpheta* species present in Awka, South East Nigeria was tested so as to establish taxonomic evidence between these species. Standard phytochemical methods were used in this analysis. The result however, revealed the presence of phenols and alkaloids in all parts of the three *Stachytarpheta* species, thus, a reason for their placement in the same family. The quantitative phytochemical result of the three *Stachytarpheta* species studied table (IV) however showed that the highest alkaloid content was in the leaf of *S. jamaicensis* (4.30±0.028) while the least alkaloid content was found in the root of *S. angustifolia* (0.17±0.023); the analysis of variance showed a significant difference in the alkaloid content between plant parts and between *Stachytarpheta* species ($p<0.05$). On the other hand, the highest phenol content was found in the leaf of *S. jamaicensis* (1.25±0.028) and the lowest phenol content was seen in the root of *S. angustifolia* (0.05±0.028); the analysis of variance shows a significant difference in the phenol content between plant parts and between *Stachytarpheta* species ($p<0.05$). Also, the specie grouping revealed by Duncan Multiple Range Test, confirms the grouping of S.jamaicencis and S.angustifolia based on the similarity in the superscripts of the phenol contents in their root and stem respectively. This result obtained from the quantitative analyses of these species may proffer a significant taxonomic solution in the placement of these *Stachytarpheta* species.

Key words: *Stachytarpheta, Cayannensis, Jamaicensis, Angustifolia,* Phytochemicals, Phenols, Alkaloids.

INTRODUCTION

Verbenaceae is predominantly a tropical family exhibiting a wide range of growth habit and inhabiting diverse habitats [4]. The family has about 98 genera and 3,000 species [19]. They are low shrubs, herbs or trees. Flowers are in spikes. The genus *Stachytarpheta* Vahl. belongs to the family Verbenaceae and is represented in West Africa and Nigeria by three species namely: *Stachytarpheta cayannensis* (Rich.) Vahl; *S. angustifolia* (Mill.) Vahl and *S. jamaicensis* (L.) Vahl

[1]. They are economic plants and may be grown as ornamentals [8]. Members of family Verbenaceae are popular in traditional medicine. Moreover, all the *Stachyrapheta* species have been used ethnomedically as anti-diabetic, arbotifacient, emmenagogue, sedative, antihypertensive, anti-asthmatic and anti-fever [11].

Stachytarpheta is an erect and branched half-woody plant, with stem slightly angled. The leaves are elliptic to oblong-ovate and 2 to 10cm long. The leaf tips ere pointed with toothed margins. The leaf base is decurrent on the petiole. The spikes are terminal, rather slender, 10-30cm long, 3-4mm thick, green and continuous. The calyx is small, oblique and 4-toothed. The corolla is deep-blue or blue-purple, 1cm long. The fruit is enclosed in the calyx and oppressed to and somewhat sunk in the rachis which is smooth, oblong and about 4mm long [19].

Phytochemistry is considered with the enormous variety of organic substance that are accumulated by plants and deals with the chemical structures of these substances, their biosynthesis, metabolism, natural distribution and biological function [16]; [18]. Phytochemistry is a systematic line of evidence and is also used in combination with other systematic lines of evidence which include but not limited to anatomy (Leaf, Stem, root), biosystematics, cytology, ecology, edaphic, genetics, gross morphology, palynology, phytogeography, but there are three main reasons for the rapid growth of phytochemistry [3].

Relatively, apart from physiognomic characters, phytochemicals, just like anatomical properties of plant parts are sources for taxonomic inferences in different groups of flowering plants [2]; [10]; [15]. Phytochemicals are therefore, chemicals derived from plants. In a narrower sense the terms are often used to describe the large number of secondary metabolic compounds found in plants [5]. Many of these are known to provide protection against insect attack and plant disease [17]. They also exhibit a number of protective functions for human consumer [5].

MATERIALS AND METHODS USED IN THE STUDY

Samples of *S.cayannensis* and *S.jamaicensis* were collected from Nnamdi Azikiwe University Premises. *S.angustifolia* was collected from Adabebe village in Amawbia Community; Awka South L. G. A. Samples of *S. cayannensis*, *S. angustifolia* and *S. jamaicensis* collected were properly and authenticated by Prof. J.C Okafor and vouchers deposited at the Herbarium, Department of Botany, Nnamdi Azikiwe University, Awka. The plant samples were air-dried and ground into uniform powder using a Thomas-Wiley milling machine. The aqueous extract of each sample was prepared by soaking 100g of dried powdered samples in 200ml of distilled water for 12hours. The extracts were filtered using Whitman filter paper No 42 (125mm). Chemical tests were carried out on the aqueous extract and on the powdered specimens using standard procedures to identify the constituents as described by [2]; [12]; [15].

RESULT

Table I: Result of Preliminary Phytochemical Analysis on *S.jamaicensis*

Phytochemical component		**Observation**	**Inference**		
			Leave	**Stem**	**Root**
Alkaloid	Mayer's and Wagner's test	Reddish brown precipitate	+	+	+
Phenols	Ferric-chloride test	Greenish-brown precipitated	+	+	+

Table I: Shows the presence of alkaloids and phenols on the leaves, stem and root of *S.jamaicensis*.

Table II: Result of Preliminary Phytochemical Analysis on *S.cayannensis*

Phytochemical component		**Observation**	**Inference**		
			Leave	**Stem**	**Root**
Alkaloid	Mayer's and Wagner's test	Reddish brown precipitate	+	+	+
Phenols	Ferric-chloride test	Greenish-brown precipitated	+	+	+

Table II: Shows the presence of alkaloids and phenols on the leaves, stem and root of *S.cayannensis*.

Table III: Result of Preliminary Phytochemical Analysis on *S.angustifolia*

Phytochemical component		**Observation**	**Inference**		
			Leave	**Stem**	**Root**
Alkaloid	Mayer's and Wagner's test	Reddish brown precipitate	+	+	+
Phenols	Ferric-chloride test	Greenish-brown precipitated	+	+	+

Table III: Shows the presence of alkaloids and phenols on the leaves, stem and root of *S.angustifolia*.

Table IV: The Quantitative Phytochemical Result on Root, Stem and Leaf of Stachytarpheta species.

Treatment	Alakaloid	Phenol
S. angustifolia (Leaf)	1.32 ± 0.028^{e}	0.12 ± 0.023^{b}
S. angustifolia (Stem)	0.73 ± 0.014^{b}	0.09 ± 0.014^{ab}
S. angustifolia (Root)	0.17 ± 0.023^{a}	0.05 ± 0.028^{a}
S. cayannensis (Leaf)	2.84 ± 0.028^{h}	0.54 ± 0.029^{d}
S. cayannensis (Stem)	1.22 ± 0.014^{d}	0.32 ± 0.014^{c}
S. cayannensis (Root)	$0.92\pm.0.014^{c}$	0.26 ± 0.025^{c}
S. jamaicensis (Leaf)	4.30 ± 0.028^{i}	1.25 ± 0.028^{e}
S. jamaicensis (Stem)	2.20 ± 0.023^{g}	0.50 ± 0.018^{d}
S. jamaicensis (Root)	1.58 ± 0.024^{f}	0.10 ± 0.011^{ab}
p-value		
Part of plant	**	**
Stachytarpheta species	**	**

Results are in Mean ± STD

*Columns with the same superscript (or sharing a common letter) are not significantly different

Table IV showing the quantitative phytochemical result of the three *Stachytarpheta* species studied. The table however shows that the highest alkaloid content was in the leaf of *S. jamaicensis* (4.30±0.028) while the least alkaloid content was found in the root of *S. angustifolia* (0.17±0.023); the analysis of variance shows a significant difference in the alkaloid content

between plant parts and between *Stachytarpheta* species ($p<0.05$). Highest phenol content was found in the leaf *S. jamaicensis* (1.25±0.028) and the lowest phenol content was seen in the root of *S. angustifolia* (0.05±0.028); the analysis of variance shows a significant difference in the phenol content between plant parts and between *Stachytarpheta* species ($p<0.05$).

DISCUSSION

The result of the phytochemical analyses on the three species of *Stachytarpheta* studied, revealed the presence of alkaloids and phenols in their leave stem and root and this therefore, supports their close relationship and placement in the same family. Generally, chemical identification of specific compounds will provide a greater insight into the relationships and differences among plant taxa [6]. The presence or absence of secondary metabolites and the biosynthetic pathways responsible for their production are useful for establishing taxonomic relationships [7].

From the result reported in table IV above, there was significant difference in the alkaloid and phenol contents in all the parts of the three Stachytarpheta species tested. This result obtained from the quantitative analyses of these species may proffer a significant taxonomic solution in the placement of these *Stachytarpheta* species. Earlier attempts have been made in several fields of Biology to place the taxonomic relationships of species upon a firm physio-chemical foundation [14].

Also, the specie grouping revealed by Duncan Multiple Range Test, confirms the grouping of S.jamaicencis and S.angustifolia based on the similarity in the superscripts of the phenol contents in their root and stem respectively. However, [9].observed that for the family *Euphorbiaceae*, secondary metabolites such as alkaloids, cyanogenic glycosides, diterpenes, glucosinolates, tannins and triterpenes are the most common metabolites of taxonomic importance at the suprageneric levels. More so, [13]. reported that physiochemical data provide much useful information concerning relationship both within the *Euphorbiaceae* and between this family and relatives.

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