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Taxonomic Implications of Flavonoids and Steroids in the Species of *Stachytarpheta* Present in Awka, Nigeria

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Abstract
The flavonoids and steroids 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 steroids and flavonoids in all parts of the three *Stachytarpheta* species, thus, a reason for their placement in the same family. On the other hand, the presence of steroids was also tested. *S. cayannensis* confirmed the presence of steroids in all the parts of the plant. Hence, steroids was absent in all the parts of *S.jamaicensis* and *S.angustifolia*, this however, can be used to delimit *S.cayannensis* from the two other *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.

Keywords: *Stachytarpheta, Cayannensis, Jamaicensis, Angustifolia*, Flavonoids, Steroids

1. Introduction
Verbenaceae is predominantly a tropical family exhibiting a wide range of growth habit and inhabiting diverse habitats [1]. The family has about 98 genera and 3,000 species [2]. 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 [3]. They are economic plants and may be grown as ornamentals [4]. 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 [5].
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 are 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 [2].
Relatively, apart from physiognomic characters, phytochemicals, just like anatomical properties of plant parts are sources for taxonomic inferences in different groups of flowering plants [6, 7, 8, 9].
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 [10]. Many of these are known to provide protection against insect attack and plant disease [10, 11]. They also exhibit a number of protective functions for human consumer [10]. 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 [8, 13]. 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 [14].
The most useful class of compounds isolated for such studies are flavonoids and steroid. Surveys of many other classes of compounds notably alkaloids, terpenes and sulphur compounds are also important. Flavonoids and steroids are secondary metabolites i.e. secondary plant products which are relatively less widespread and play important role in plants by protecting them against external pathogens, ultraviolet light or heat and in the pollination

process by attracting insects [10, 15, 8]. Additionally, flavonoids are also responsible for the red, purple and blue colour of fruits, petals of flower. It is this restricted occurrence amongst plant species that renders flavonoids and steroids valuable as taxonomic markers. Flavonoids and flavones are the two most important classes of flavonoids for chemotaxonomic investigation [6].

2. 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 [6, 14, 15].

3. Result

Table 1: Result of Preliminary Phytochemical Analysis on *S.cayannensis*

Phytochemical component	Test	Observation	Inference		
			Leave	Stem	Root
Steroids	Salkowkis test	Red colour at interface	+	+	+
Flavonoid	Ammonium test	Yellow colour	+	+	+

Table 1: Showed the presence of the tested constituents on the leaves, stem and root of *S.cayannensis* but steroid was absent in all parts of the plant.

Table 2: Result of Preliminary Phytochemical Analysis on *S.angustifolia*

Phytochemical component	Test	Observation	Inference		
			Leave	Stem	Root
Steroids	Salkowkis test	Red colour at interface	-	-	-
Flavonoid	Ammonium test	Yellow colour	+	+	+

Table 2: Showed the presence of flavonoid in the leaves, stem and root of *S.angustifolia* but steroid was absent in all parts of the plant.

Table 3: Result of Preliminary Phytochemical Analysis on *S.jamaicensis*

Phytochemical component	Test	Observation	Inference		
			Leave	Stem	Root
Steroids	Salkowkis test	Red colour at interface	-	-	-
Flavonoid	Ammonium test	Yellow colour	+	+	+

Table 3: Showed the presence of flavonoid in the leaves, stem and root of *S.jamaicensis* but steroid was absent in all parts of the plant.

4. Discussion

The flavonoids and steroids content of the three *Stachytarpheta* species present in Awka, South East Nigeria was tested so as to establish taxonomic evidence. Relatively, 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 [13]. From the result above, flavonoid was present in all parts of the three Stachytarpheta species, thus, a reason for their placement in the same family. However, [16] 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.

On the other hand, the presence of steroids was also tested. *S.cayannensis* confirmed the presence of steroids in all the parts of the plant. Hence, steroids was absent in all the parts of *S.jamaicensis* and *S.angustifolia*, this however, can be used to delimit *S.cayannensis* from the two other *Stachytarpheta* species tested. More so, [17] reported that physiochemical data provide much useful information concerning relationship both within the *Euphorbiaceae* and between this family and relatives.

Generally, chemical identification of specific compounds will provide a greater insight into the relationships and differences among plant taxa [18]. The presence or absence of secondary metabolites and the biosynthetic pathways responsible for their production are useful for establishing taxonomic relationships [19]. Earlier attempts have been made in several fields of Biology to place the taxonomic relationships of species upon a firm physio-chemical foundation [20].

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