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Phytochemical screening, Quantitative estimates of Bioactive compounds in *Spondias mombin* and *Azadirachta indica*

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Abstract

The study was carried out to evaluate the pesticidal properties of Azadirachta indica and Spondias mombin leaves against the activities of Phytolyma lata. The leaf extracts of Azadirachta indica and Spondias mombin were prepared using different solvents like methanol, chloroform and petroleum ether and were screened for their pesticidal properties. The results of the quantitative analysis showed that the leaves of both S.mombin and A.indica contained phenol, tannins, flavonoids, saponins, glycocides, steroids and alkaloids. Phytochemical screening of the bioactive compounds showed that the phenol, tannins, flavonoids, saponins, glycosides, steroids, and alkaloid contents of the leaves of S.mombinwas 1.00a ± 0.10, 3.80a ± 0.10, 2.98a ± 0.01, 7.40a ± 0.10, 0.02a ± 0.01, 1.27a ± 0.10 and 5.81a ± 0.01, while the leaves of A.indica contained 0.18b ± 0.01, 0.23b ± 0.01, 0.43b ± 0.01, 0.72b ± 0.01, 0.01a ± 0.01, 0.20b ± 0.00 and 1.38b ± 0.01 respectively. Both leaf extracts possessed the sampled bioactive compounds although in varying quantities. A study of the results obtained from both leaf extracts indicated that a higher quantity of bioactive compounds in S. mombin may be responsible for a more effective pest control than A. indica.

Keywords: Spondias mombin, Azadirachta indica, phytochemicals, phenol, tannins, flavonoids etc.

Introduction

Agriculture and forestry have had to face the destructive activities of numerous pests like fungi, weeds and insects from time immemorial, leading to radical decrease in yields. With the advent of chemical pesticides, this crisis was resolved to a great extent. Notwithstanding this, the over dependence and eventual uninhibiteduse of chemical pesticides has necessitated for alternatives mainly for environmental concerns. Degraded soils and groundwater pollution have resulted in nutritionally imbalanced and unproductive lands. Volatile pesticide residues also sometimes raise food safety concerns among domestic consumers and pose trade impediments for export crops. Therefore, an ecofriendly alternative is the need of the hour. Biopesticides or biological pesticides based on pathogenic microorganisms specific to a target pest offer an ecologically sound and effective solution to pest problems[1]. Biopesticides pose less threat to the environment and to human health. There are several benefits of biopesticides to various programs such as agriculture and public health as they are less harmful, and targeted at a specific pest. Often times, small quantities have high decomposition rate and are sufficient to control organisms thereby preventing the prevalent pollution problems.

Azadirachta indica has been widely known to possess high pesticidal properties in addition to its medicinal properties. The bioactive compounds such as phenols, tannins, saponins, alkaloids are largely responsible for this. Similarly, *Spondias mombin* has also been known to possess medicinal properties even though there is paucity of literature on its pesticidal properties. Hence, this study is therefore, designed to determine and compare the pesticidal properties of the aqueous leaf extract of *Spondias mombin* and *Azadirachta indica*.

Materials and Methods

Sample Collection and Preparation: Fresh leaves of *S. mombin* and *A.indica* were collected in the month of June 2013, using secateurs, from mature stands in Umudike, Abia State, Nigeria. The leaves were washed thoroughly with running tap water to remove dust, pollen and other particles, and then air-dried for seven (7) days to a constant weight. A mechanical grinder was used to grind the dried leaves into powder form. The ground leaves were further packaged into glass jars and stored at 4^0C prior to analysis.

Phytochemical Analysis: Five (5) grams of dried powdered leaves was macerated in a 500ml beaker after which 200ml of distilled water was added. The solution was heated using a hot plate and was stirred continuously at 30-40^0C for about 20mins. The aqueous extract was further filtered using muslin cloth and then a Whatman No.1 filter paper. The filtrate obtained was used for the phytochemical analysis. The phytochemical properties determined included phenol and tannins, flavonoids,

saponins, glycosides, steroid, alkaloids of both *S. mombin* and *A. indica.* Phytochemical screening on the samples was carried out using the method described by Sofowara[2] and AOAC[3]. Percentage composition of phenol, glycoside, and steroids were performed using the methods described by Harborne[4] and Trease and Evans[5]. Alkaloid was extracted using the method of Maxwell *et al*.[6], tannins and flavonoid were determined by the Bohm and Kocipai-Abyazan method[7] while Peng and Kobayasli[8] method was used to analyze for saponins.

Results and Discussion

The results of the phytochemical screening of *Spondias mombin* and *Azadirachta indica* is summarized in Table-1. The results showed that both leaves contain alkaloids, flavonoids, tannins, saponins, glycosides, steroids and phenolic compounds. The quantitative estimates in percentage of the phytochemicals are as shown in Table-2. The results indicate that the percentage composition of Phenol (1.00±0.10%), tannins (3.80±0.10%), flavonoids (2.98±0.01%), saponins (7.40±0.10%), steroids (1.27±0.10%) and alkaloids (5.81±0.01%) in *S. mombin* was significantly higher than the corresponding values (0.18±0.01%, 0.23±0.01%, 0.43±0.01%, 0.72±0.01%, 0.20±0.00%, 1.38±0.01%) obtained in leaves of *A. indica* respectively. However, the result indicates that the value of glycosides obtained in *S. mombin* (0.02±0.01%), is statistically equal ($P \leq 0.05$), to the value obtained in *A. indica*(0.01±0.01%).

The results of the study indicates the presence of high contents of saponins, alkaloids and flavonoids were observed in the leaves of the *S.mombin* and *A.indica*. The phytochemicals exhibit various pharmacological and biochemical actions when ingested by animals. Plant bioactivity depends on chemical compounds which may inhibit insect feeding[9,10]. Agroecosystems are an important system for secondary plant metabolites and their degradation products. Toxic effects to insect pests are produced by the following compounds: terpenoids and steroids, phenols, coumarins, flavonoids, tannins, alkaloids, and cyanogenic glycosides[11]. Toxicity of *Spondias mombin* leaves is attributed to several components such as saponins, lectin (curcin), phytates, protease inhibitors and curcalonic acid. Some parts of *S.mombin* leaves are used in tropical countries to treat different ailments, and have shown pesticidal properties to a variety of insect pests, the high Alkaloid (5.81%), Flavonoid (2.98%), and Phenol (1%) contents of the leaves in this study indicates their potential for pesticidal inhibition.

Pesticidal properties of Neem are linked to a general class of products called "triterpenes". These have the ability to block insect growth in a wide variety of most deadly pests of agriculture and human health. Aside the limonoids, fresh and dry bark of stem, mature and tender leaves, roots, flower and different parts of Neem fruits are also rich in secondary metabolites[12]. High secondary components contained in the Neem leaves as shown in this study, further highlights its potential for use as a plant pesticide.

Phenolic compounds have been intensively studied with regard to their toxicity[13,14]. They play important roles in plant herbivore and pathogen interactions[15]. One of the largest groups of plant metabolites are the phenolic compounds[12]. The antioxidant properties of pesticidal plants have been described by various studies which are rich in phenolic compounds[16]. Phenolic compounds usually produce natural oxidants such as flavonoid, phenolic acids, tocopherols etc[17]. Plants have naturally occurring substances called flavoniods[18]. Flavonoids are important in legumes as they play a vital role in resistance. These compounds serve as natural pesticides[19]. Flavonoids have thhe capacity to modulate the feeding behavior of insects[20]. Similarly, they aid in the normal growth of plantsand development against injury by pests. Field studies show that plant species which are high in several components such as flavonoids and tannins possess the greatest insect resistance[21].

Table-1
Phytochemical screening of S*pondias mombin* and A*zadirachta indica* leaves

Sample	Phenol	Tannins	Flavonoids	Saponins	Glycosides	Steroids	Alkaloids
Spondias mombin	+	+	+	+	+	+	+
Azadirachta indica	+	+	+	+	+	+	+

+ Represents presence, - No activity, Values are mean±standard deviation of three replicates

Table-2
Quantitative estimates of phytochemicals of S*pondias mombin* and A*zadirachta indica* leaves (%)

Sample	% Phenol	% Tannins	% Flavonoids	% Saponins	% Glycosides	% Steroids	% Alkaloids
S*pondias mombin*	$1.00^{a} \pm 0.10$	$3.80^{a} \pm 0.10$	$2.98^{a} \pm 0.01$	$7.40^{a} \pm 0.10$	$0.02^{a} \pm 0.01$	$1.27^{a} \pm 0.10$	$5.81^{a} \pm 0.01$
A*zadirachta indica*	$0.18^{b} \pm 0.01$	$0.23^{b} \pm 0.01$	$0.43^{b} \pm 0.01$	$0.72^{b} \pm 0.01$	$0.01^{a} \pm 0.01$	$0.20^{b} \pm 0.00$	$1.38^{b} \pm 0.01$
P-VALUE	0.05	0.40	0.80	0.70	0.288	0.56	0.39

Values are means±standard deviation of three replicates, ^{a,b} means in a column with different superscripts are significantly different (P<0.05)

Extracts and oil from leaves and bark of tropical plants in the families of Aiperaceae, Zingiberaceae and Anacadaceae have higher chemical composition. The higher values of chemical composition obtained in leaves of *S. mombin* may be attributed to the inherent ability of *S. mombin* to synthesize the various substances (phenol, tannins, flavonoids, saponins, steroids and alkaloids).

Indeed, the content of saponin and alkaloids obtained in *S. mombin* were relatively higher compared to values obtained for tannins, flavonoids, steroids, phenol and glycosides for the same plant species (i.e. *S. mombin*). Similarly, it was also observed that the content of saponin and alkaloid were higher in *A. indica* relative to other substances (tannins, flavonoids, steroids, phenol and glycosides) tested in this study.

Conclusion

Thus in our present study, the phytochemical screening of the aqueous leaf extracts of *A. indica* and *S. mombin* leaves revealed the presence of many phytocomponents. The result obtained in this study suggeststhat these plants are a valuable reservoir of bioactive compounds of substantial pesticidal merit. This study may be useful to explore the pharmacological and biosynthetic activity of *A. indica* and *S.mombin* plant further.

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