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Preliminary Phytochemical Analysis of some Plant Seeds

Ajayi I. A., Ajibade O. and Oderinde R. A.
Industrial Unit, Chemistry Department, Faculty of Science, University of Ibadan, Ibadan, NIGERIA

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Abstract

The screening and study of seven different plant specimens belonging to different families for phytochemical constituents was performed using generally accepted laboratory technique for qualitative determinations. The constituents screened for were tannins, saponins, phlobotannins, terpenoids, flavonoids, cardiac glycosides, combined anthraquinone, free-anthraquinone, carotenoids, steroids, reducing compounds and alkaloids. The distribution of these constituents in the plant specimens were assessed and compared. The plant seeds studied were Artocarpus communis, Artocarpus heterophyllus, Calophyllum inophyllum, Garcinia kola, Garcinia mangostana, Pentaclethra macrophylla and Treculia africana. All the plant specimens were found to contain flavonoids and reducing compounds but none of them contain phlobatanin, cardiac glycoside, combined anthraquinone, free anthraquinone, carotenoid and steroids. They also contain tannins (except Artocarpus communis), saponins (except Artocarpus heterophyllus) and terpenoids (except Artocarpus communis). Alkaloids were found in four out the seven specimens. Some of the plant seeds seemed to have potential as source of useful drugs.

Key Words: Plant seeds, screening, phytochemical, constituents

Introduction

Naturally occurring substances are of plants, animals and mineral origin. They are organic substances and could be obtained in both primary and secondary metabolic process; they also provide a source of medicine since the earliest time. The plant kingdom has proven to be the most useful in the treatment of diseases and they provide an important source of all the world's pharmaceuticals. The most important of these bioactive constituents of plants are steroids, terpenoids, carotenoids, flavanoids, alkaloids, tannins and glycosides. Plants in all facet of life have served a valuable starting material for drug development[1]. Antibiotics or antimicrobial substances like saponins, glycosides, flavonoids and alkaloids etc are found to be distributed in plants, yet these compounds were not well established due to the lack of knowledge and techniques[2]. The phytoconstituents which are phenols, anthraquinones, alkaloids, glycosides, flavonoids and saponins are antibiotic principles of plants. From these phytoconstituents, saponins have been reported to exhibit hemolytic and foaming activity[3], antifungal[4], anti-inflammatory[5], fungistatic[6], molluscidal[7].

Plants are now occupying important position in allopathic medicine, herbal medicine, homoeopathy and aromatherapy. Medicinal plants are the sources of many important drugs of the modern world. Many of these indigenous medicinal plants are used as spices and food plants; they are also sometimes added to foods meant for pregnant mothers for medicinal purposes[8,9]. Many plants are cheaper and more accessible to most people especially in the developing countries than orthodox medicine, and there is lower incidence of adverse effects after use. These reasons might account for their worldwide attention and use[10]. The medicinal properties of some plants have been documented by some researchers[11,12,13]. This study looks into the fundamental scientific bases for the use of some medicinal plant seeds by determining the crude phytochemical constituents present in these plants.

Materials and Methods

Plant specimen and collection: The fresh seeds of Artocarpus communis, Artocarpus heterophyllus, Calophyllum inophyllum, Garcinia kola, Garcinia mangostana, Pentaclethra macrophylla and Treculia africana were collected from Botanical Garden, University of Ibadan, Oyo State. The plants were identified and authenticated at Herbarium Unit of Botany Department, University of Ibadan. The fresh seeds were air dried at room temperature until dried. The dried plant seeds were blended using a blender and stored in a clean glass ware container until needed for analysis. The extracts were filtered using Whatmann filtered paper no. 42 (125 mm).

Phytochemical screening: Chemical test were carried out on the aqueous extract and on the powdered specimen using standard procedure to identify the constituents as described by Mojab *et al.*[14] Harborne[15], Sofowora[10] and Trease and Evans[16].

Test for tannins: 1 g of each powdered sample was separately boiled with 20 ml distilled water for five minutes in a water bath and was filtered while hot. 1 ml of cool filtrate was distilled to 5 ml with distilled water and a few drops (2-3) of 10 % ferric chloride were observed for any formation of precipitates and any colour change. A bluish-black or brownish-green precipitate indicated the presence of tannins.

Test for saponins: 1 g of each powdered dried stain was separately boiled with 10ml of distilled water in a bottle bath for 10minutes. The mixture was filtered while hot and allowed to cool. The following tests were then carried out.

Demonstration of frothing**:** 2.5 ml of filtrate was diluted to 10ml with distilled water and shaken vigorously for 2minutes (frothing indicated the presence of saponin in the filtrate).

Demonstration of emulsifying properties: 2 drops of olive oil was added to the solution obtained from diluting 2.5 ml filtrate to 10 ml with distilled water (above), shaken vigorously for a few minutes (formation of a fairly stable emulsion indicated the presence of saponins).

Test for phlobatannins: Deposition of a red precipitate when an aqueous extract of each plant sample was boiled with 1 % aqueous hydrochloric acid was taken as evidence for the phlobatannins.

Test for terpenoids: 5 ml of each extract was mixed in 2 ml of chloroform. 3 ml of concentrated H_2SO_4 was then added to form a layer. A reddish-brown precipitate colouration at the interface formed indicated the presence of terpenoids.

Test for flavonoids: 1 g of the powdered dried leaves of each specimen was boiled with 10 ml of distilled water for 5 minutes and filtered while hot. Few drops of 20 % sodium hydroxide solution were added to 1 ml of the cooled filtrate. A change to yellow colour which on addition of acid changed to colourless solution depicted the presence of flavonoids.

Test for cardiac glycosides: 5 ml of each extract was treated with 2 ml of glacial acetic acid containing one drop of ferric chloride solution. This was underplayed with 1ml of concentrated sulphuric acid. A brown ring at the interface indicated the deoxysugar characteristics of cardenolides. A violet ring may appear below the ring while in the acetic acid layer, a greenish ring may be formed.

Test for combined anthraquinones: 1 g of powdered sample of each specimen was boiled with 2 ml of 10 % hydrochloric acid for 5 mins. The mixture was filtered while hot and filtrate was allowed to cool. The cooled filtrate was partitioned against equal volume of chloroform and the chloroform layer was transferred into a clean dry test tube using a clean pipette. Equal volume of 10 % ammonia solution was added into the chloroform layer, shaken and allowed to separate. The separated aqueous layer was observed for any colour change; delicate rose pink colour showed the presence of an anthraquinone.

Test for free anthraquinones: 5 ml of chloroform was added to 0.5 g of the powdered dry seeds of

each specimen. The resulting mixture was shaken for 5 mins after which it was filtered. The filtrate was then shaken with equal volume of 10 % ammonia solution. The presence of a bright pink colour in the aqueous layer indicated the presence of free anthraquinones.

Test for carotenoids: 1 g of each specimen sample was extracted with 10 ml of chloroform in a test tube with vigorous shaking. The resulting mixture was filtered and 85 % sulphuric acid was added. A blue colour at the interface showed the presence of carotenoids.

Test for reducing compounds: To about 1 g of each sample in the test tube was added 10 ml distilled water and the mixture boiled for 5 mins. The mixture was filtered while hot and the cooled filtrate made alkaline to litmus paper with 20 % sodium hydroxide solution. The resulting solution was boiled with an equal volume of Benedict qualitative solution on a water bath. The formation of a brick red precipitate depicted the presence of reducing compound.

Test for alkaloids: 1 g of powdered sample of each specimen was separately boiled with water and 10 ml hydrochloric acid on a water bath and filtered. The pH of the filtrate was adjusted with ammonia to about 6-7. A very small quantity of the following reagents was added separately to about 0.5 ml of the filtrate in a different test tube and observed.

Picric acid solution.

10% tannic solution.

Mayer's reagent (Potassium mercuric iodide solution).

The test tubes were observed for coloured precipitates or turbidity.

Results and Discussion

Presented on table 1 is the scientific, family, English and local names of the plant seeds that were screened for phytochemical constituents. Also inclusive is the abbreviation of the names of these plants. The screening of these seven different plant seed species namely *Artocarpus communis, Artocarpus heterophyllus, Calophyllum inophyllum, Garcinia kola*, *Garcinia mangostana, Pentaclethra macrophylla* and *Treculia africana* for phytochemical constituent was performed using generally accepted laboratory technique for qualitative determinations. The study indicated that saponins, flavonoids and reducing sugars were present in all the aqueous extract of these plants but none contain phlobatannins, cardiac glycosides, combined anthraquinones, carotenoids and steroids [Table 2]. It should be noted that steroidal compounds are of importance and interest in pharmacy due to their relationship with such compounds as sex hormones[1,9]. All the plant extracts except *Artocarpus communis* were found to contain tannins and terpenoids. Out of all the seven plant seed extract studied, only *Garcinia mangostana, Pentaclethra macrophylla* and *Treculia africana* contain alkaloids.

The importance of alkaloids, saponins and tannins in various antibiotics used in treating common pathogenic strains has recently been reported by Kubmarawa *et al.*[17]. Mensah *et al.*[18] reports alkaloids in 12 leafy vegetables studied. Ayitey-Smith and Addae-Mensah[11] had earlier recorded that bitter leaf contains an alkaloid which is capable of reducing headaches associated with hypertension.

The comparison of the phytochemical constituents of the plant seed extracts of *Artocarpus communis, Artocarpus heterophyllus* and *Treculia africana* from the Moraceae family showed that all the three contain flavonoids and reducing sugars but none of them contain phlobatannin, cardiac glycosides, combined anthraquinones, carotenoids and steroids. Two of them, *Artocarpus heterophyllus* and *Treculia africana,* contain tannins and terpenoids while *Artocarpus communis* does not. However, *Artocarpus communis* and *Treculia africana* contain saponin but *Artocarpus heterophyllus* does not. Out of all the three, only *Treculia africana* contain alkaloids, the other two seeds belonging to the same family Moraceae do not.

Calophyllum inophyllum, Garcinia kola and *Garcinia mangostana* belong to the same family of Guttiferae. The seeds from these three plants all contain tannins, saponins, terpenoids and flavonoids while only two contain reducing sugars and alkaloids. The medicinal importance of tannins and saponins which are some of the components of traditional herbal preparations used in managing various common ailments has been reported by Addae-Mensah[19], Okoegwale and Olumese[20] and Okoegwale and Omofezi[21]. Banso and Adeyemo[13] have reported the antibacterial properties of tannins. Phlobatannins, cardiac glycosides, combined anthraquinones, free anthraquinones carotenoids and steroids are absent in all the seeds. The fact that these are absent in these seeds from the Gutifferae family make them show similarity to those ones from the Moraceae family. They however differ from the seeds of the plants from the Moraceae family in that all the three seeds from the Gutifferae family contain tannins, saponins and terpenoids while only two of the Moraceae family contains these. This suggests that the seeds from the family of the Guttiferae might have more useful application in ethnomedicine than the seeds from the family of Moraceae.

Conclusion

Some of the plant seeds screened for phytochemical constituents seemed to have potential as source of useful drugs and also to improve the health status of its users as a result of the presence of various compounds that are vital for good health. Quantitative analysis of the phytochemicals of these plant seeds and also the anti-fungal and anti-microbial activities should be investigated.

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Table-1: Scientific, Family, English and Local names of the seeds investigated

Scientific Name	Family Name	English Name	Local Name	Abbreviation
Artocarpus communis	Moraceae	Breadfruit	[a]NA	AC
Artocarpus heterophyllus	Moraceae	Jack fruit	[a]NA	AH
Calophyllum inophyllum	Guttiferae	[a]NA	[a]NA	CI
Garcinia kola	Guttiferae	[a]NA	Orogbo	GK
Garcinia mangostana	Guttiferae	[a]NA	[a]NA	GM
Pentaclethra macrophylla Benth	Leguminosae-mimosoideae	African oil bean	Ugba	PM
Treculia Africana	Moraceae	[a]NA	Ukwai	TA

[a]NA = Not available

Table-2: Result of the phytochemical screening of the plant seeds

Plant name	[a]TA	[a]SAP	[a]PHL	[a]TER	[a]FLA	[a]CAR	[a]COM ANTH	[a]FR ANTH	[a]CAR	[a]STER	[a]RED	[a]ALK
AC	-	+	-	-	+	-	-	-	-	-	+	-
AH	+	-	-	+	+	-	-	-	-	-	+	-
CI	+	+	-	+	+	-	-	-	-	-	+	-
GK	+	+	-	+	+	-	-	-	-	-	-	+
GM	+	+	-	+	+	-	-	-	-	-	+	+
PM	+	+	-	+	+	-	-	-	-	-	+	+
TA	+	+	-	+	+	-	-	-	-	-	+	+

[a]TA=tannins [b]SAP= saponins [c]PHL= phlobatannins [d]TER= terpenoids [e]FLA=flavonoids [f]CAR=cardiac glycosides [g]COM ANTH= combined anthraquinones [h]FR ANTH= free anthraquinones [i]CAR= carotenoids [j]STER= steroids [k]RED= Reducing compounds, [l]ALK= alkanoids , + = Present, - = Absent