

PHYTOCHEMICAL SCREENING OF THE ROOT, BARK, AND LEAVES OF FLAMBOYANT TREE IN NIGERIA

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Abstract

Phytochemical screening of the roots, bark, and leaves of the flamboyant tree in Nigeria was performed using standard procedures in water, ethyl acetate, and ethanol extracts. Tannins, saponins, carbohydrates, glycosides, resins, phlobatannins, alkaloids, and flavonoids were found in the samples using a simple quantitative method. Phytochemical screenings revealed compounds found in plants that had previously been extensively researched as a source of medicinal agent; thus, it is expected that phytochemicals will be used for the treatment of bacterial infections. Since time immemorial, man has used various parts of plants in the treatment and prevention of various ailments.

Keywords: Phytochemical Screening, *Delonix regia*, medicinal properties, treatment, prevention, ailments.

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INTRODUCTION

Delonix regia is also known as royal *poinciana regia* or flamboyant it belongs to caesalpiniaceae family according to the traditional classification or to the 'fabaceae' family, according to the phylogenetic classification. It is considered one of the most beautiful tropic trees in the world that produces in spring striking flame like scarlet and yellow flowers before the leaves emerge. This tree, originally from Madagascar, but nowadays found in several countries of the intertropical zone, is often used to locally prepare extract known to have medicinal properties. It was reported in the literature antimicrobial and antifungal activities and used as antibiotics in Ivory Coast, traditional medicines are prepared from several parts of the tree, including the flowers (Joy, *et al.*, 2001).

In rural areas, water extracts are generally home made from *Delonix regia* flowers. These flower extracts have never been investigated with modern analytical techniques to determine their molecular structures. Only few papers have reported on anthocyanin contents in extract of *Delonix regia* (Gupta, 1971) and their possible uses, such as natural pH indicators. One tentative anthocyanin identification was made in 1971 on *Delonix regia* extracts, collected near Cairo (Sultan and Sirry, 2002), the paper briefly reported that these extracts contained only two anthocyanin's gentiobioside, which were not quantified.

The royal Poinciana (*Delonix regia*) is endemic to Madagascar, where it is found in the Madagascar dry deciduous forests. In the wild it is endangered, but it widely accumulated elsewhere. In addition to its ornamental value, it is also a useful shade tree in tropical conditions, because it usually grows to a modest height but species widely, and its dense foliage provides full shade in areas with a marked dry season, it is virtually evergreen.

The flowers are large, with four spreading scarlet or orange red petals up to sowing, and 8cm upright petal called the standard, which is slightly larger and spotted with yellow and white. The naturally occurring variety flevida has yellow flower (Don, 2005) seeds pods are dark brown and can be up to 60cm long and 5cm wide, the individual seeds, however, are small, weighing around 0.4g on average. The compound leaves a feathery appearance and are a characteristic light, bright green. They are doubly pinnate each leaf is 30 to 50cm long and has 20 to pairs of primary leaflets or pinnae on it, and each of these is further divided into 10 to 20 pairs of secondary leaflets or pinnacles.

The Royal Poinciana is regarded as naturalized in many of the locations where it is grown, and is seen by some as an invasive species in some parts of Australia, partly because its dense shade and roots system prevent the growth of other species under it. Although it is a very popular street plant in a lot of suburbs of Brisbane, Australia. It is also found in Indus and Pakistan, where it is referred to as the gulmother, or gulmoli (Cowan, 1984) in West Bengal (India) and Bangladesh it is called Krishnachura.

In Vietnam, this tree is called “Phuong vy” or phoenix’s tall, and is a popular urban tree in much of Vietnam. Its flowering season is May to July, which coincides with the end of the school year in Vietnam. Because of this thing, the flower of Poinciana is sometimes called the “flower of pupil”, and often generates strong emotions among graduating high school pupils, as the Poinciana bloom when they are about to leave their childhood behind. That phony city has a nickname of “city of red Poinciana”.

The seed pods of the Royal Poinciana are used in the Caribbean as a percussion instrument known as the shak to shak or mereca.

Statement of the Problem

Despite the extensive use of this plant in herbal medicine within this region, reports or detailed phytochemical investigation on leaves, bark and root of *Delonix regia* are rather too scanty, out of many potent phytochemical available tannin, saponins, resins, flobatannins, glycosides, carbohydrate, phlobatannins and alkaloids were initially chosen for this research work.

Objectives of the Study

The aim of the project was to determine the phytochemicals present in leaves, bark and roots of *Delonix regia*. It is believes that this study would add to present knowledge phytochemistry.

LITERATURE REVIEW

Delonix regia

Plant has been of great importance to the animal kingdom. It contributes either as a source of food or shelter in the primitive ages, plants were also used for clothing therefore provides the basic needs of humans and animal as well. Out of these plants medicinal plants are common and are source of much attention in Africa (Aken’Ova and Atta-Krah, 1986).



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Uniformity of the quality of drug is also of great importance as for the therapeutically active constituent of raw materials is concern. This makes it possible for pharmacist to prescribe numerical values through which commodities are assessed and are used to ensure uniformity of standards (Aulude *et al.*, 2004).

Medical plant (Akinmoladun *et al.*, 2007), is defined as one, which contains substances that can be used for therapeutic purpose and its precursor for the synthesis of useful drugs. They contain nutrients that can heal the body (Frease and Evans, 1985) materials like these plants that has cellular structure is referred to as organized drug in pharmacy and those with non-cellular structure as unorganized or a cellular drugs (Akinpelu and Onakoya, 2006).

Woody plants are versatile material plant having a wide range of local the applications, the leaves antipyretic laxative, analgesic antifungal antibacterial and non-inflammatory (Faruq *et al.*, 2004). All these functional characteristics of wood plants are mainly due to the presence of phytochemicals.

Sansevieria trifasciata which have more than fifty species are known to grow in Africa, Asia and Florida, it is also referred to as Africa bowstring hemp, whipcord hemp. The leaves, which grow stiff and alright are dark green with irregular horizontal bands of a lighter shade. The extracts from the leaves have been reported to have various ethno-medicinal application.

Phytochemical

Phytochemical revealed the compounds which are present in plant, in recent years, secondary plant metabolites (phytochemicals), previously have been extensively investigated as a source of medicinal agent, thus, it is anticipated that phytochemicals will be used for the treatment of bacterial infections since time immemorial, man has used various parts of plants in the treatment and prevention of various ailments (Aqil, 2003).

Usefulness of Phytochemical in Health

Infectious diseases are the leading cause of death world – wide Antibiotic resistance has become a global concern, the cubical efficacy of many existing antibiotics is being threatened by the emergence of mulching – resistance pathogens. Many infectious diseases have been known to be treated with natural products, either as pure compounds or as standardized plant extracts, provide unlimited opportunities for new drug leads because of the unmatched availability of chemical diversity. There is a continuous and urgent need to discover new antimicrobial compounds with diverse chemical structures novel mechanism of action for new and re – emerging infectious disease. Therefore researchers are increasingly turning their attention to folk medicine, looking for new leads to develop better drugs against microbial infections. The increasing failure of chemotherapeutic and antibiotic resistance exhibited by pathogenic microbial infectious agents has led to the screening of several medicinal plants for their potential antimicrobial activity.

Overview

The potential for developing antimicrobials from higher plants appears rewarding as it will lead to the development of a phytomedicine to act against microbes.

Plant – based antimicrobials have enormous therapeutic potentials as they can serve they can serve the purpose with lesser side effects that are often associated with synthetic antimicrobials (Iwu *et al.*, 1999). Continued further exploration of plant derived antimicrobials is needed today. Further research is necessary to determine the identity of the antibacterial compounds from within these plants and also to



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determine their full spectrum of efficacy. However, the present study of in vitro antimicrobials evaluation of some plants forms a primary plant form for further phytochemical and pharmacological studies.

Similar – results were also reported by (Nicolaou, et al., 2007) who reported disease such as pneumonia, urinary and respiratory tract infection, nosocomial pathogens and opportunistic infection caused by *klebsiella* species. The studied plants were most active against Gram – positive bacteria the extracts of some plant could not inhibit any of the bacterial strains studied, the significant antibacterial activity of the plant extracts was comparable to the standard antimicrobics.

Phytochemical Screening

Screening of plant species is the systematic means of observation made in discovering the essential components readily available in plant. Phytochemical screening is the process of washing on the extracts of a plant species by chemical processes for bio-activity against pest and some of the other properties of the plant that may constituent new avenues of pest control material or prototypes of such materials and to the trend (Aliyu *et al.*, 2008), these has been world wide effort aimed at screening plant species for bio – activity against pest.

The relevance of phytochemical screening is very important in the constituting portions of using various plant species for the formulation of drugs and some other ethno – medicinal constituents, that is to know the plant species that possess the essential component necessary for the formulation of desired drugs and cure of cascade under illnesses. This reforms the combination of the essential components of plant species for the types of use either for scientific use or ethno – medical applications (Abulude *et al.*, 2001).

Others Information Necessary

Phytochemicals contain major groups, some of them are the polyphenols includes a large subgroup of chemical called flavonoids.

Flavonoids are plant chemical found in a being range of fruits grains and vegetable. They are being studied to find out whether they can prevent chronic diseases such as cancer and health diseases. The Isoflavones found in foods and supplements such as soya products, garbanzo beans and licorice, and the lignans found in flaxseed and whole grains may mimic the actions of the female hormone estrogen (see licorice and soyabean). These estrogen like substances from these plant sources are called phytochemicals. They may play a role in the development and protection against some hormone – dependent cancer such as some types of breast and prostate cancer (Aqil, 2003).

Saponins are a class of chemical compounds, one of many secondary metabolites found in natural sources, with saponins found in particular abundance in various plant species specifically, they are amphipathic glycoside grouped phenomenologically by the soap – like foaming they produce when shaken in aqueous solutions, and structurally by their composition of one or more hydrophilic glycoside moieties combined with a lipophilic triterpene derivative (Marston, 1995).

Medical Uses

There is tremendous, commercially driven promotion of saponins as dietary supplements and nutraceuticals. There is evidence of the presence of saponins in traditional medicine preparation, where oral administrations might be expected to lead to hydrolysis of glycoside from terpenoid (and obviation of any toxicity associated with the intact molecules). But as is often the case with wide – ranging commercial therapeutic claims for natural products (Abulude *et al.*, 2004).



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Alkaloids

Alkaloids are a group naturally occurring chemical compounds which mostly contain basic nitrogen atoms. This group also includes some related compounds with neutral and even weakly acidic properties. Also some synthetic compounds of similar structure are attributed to alkaloids in addition to carbon, hydrogen and nitrogen, alkaloids may also contain oxygen, sulfur and more rarely other elements such as chlorine, bromine and phosphorus (Robert, 1998).

Alkaloids are produced by a large variety of organisms, including bacteria, fungi, plants and animals and are part of the group of natural products (also called secondary metabolites) many alkaloids can be purified from crude extracts by acid – base extraction. Many alkaloids are toxic to other organisms. They often have pharmacological effects and are used as medications, as recreational drugs or in entheogenic rituals.

MATERIALS AND METHODS

Collection

The fresh leaves of *Delonix regia* (Figure 1) as well as the bark and the roots used for this analysis were collected at the back of College Hall, West Campus of the Federal College of Agriculture, Akure, Ondo State between May and June, 2011.

The sample were taken to the Department of General Studies, Chemistry Laboratory, Federal College of Agriculture, Akure for analysis.

The leaves, bark and the roots of the plant were properly washed with clean water, sundried for 5 days and oven dried at temperature of 40-45°C for 2 days. The dried leaves, bark and the roots of the plant were pulverized using a Kenwood blender to obtain a powder form. The powered form of these plants were stored in plastic container and kept in ambient temperature prior analysis.

Preparation of Extract of Plant Sample

The extracts of the samples were performed using the following methods. Ten grams (10g) of the sample was weight and soaked in 10meter of solvent and allowed to stand for 3 hours. This was later filtered using double fitter papers. The fitter later was collected and store prior to analysis. The methods above were used for all the solvents namely water, ethyl acetate and ethanol.

Phytochemical Analysis of *Delonix regia*

Materials (*leaves, bark and roots*)

Tannins, saponins, carbohydrate, glycosides, resins phlobatannins, alkaloids and flavonoids presence were detected in the samples using simple quantitative method.



Procedure

Test for Tannins

Two drops of 5% FeCl_3 was added to 1cm^3 of the extract, a dirty green precipitate was observed in each of the extract.

Test for Carbohydrates

Fehling Test

A mixture (5cm^3) of equal volumes of Fehling's A and B was added to 2cm^3 of each extract in a test tube. The resultant mixture was boiled for 2 minutes. A brick red precipitation of copper was observed from the leaves diluted with water while the test mixed with ethanol and ethyl acetate gave green colouration.

Test for Saponins

Each extract (2cm^3) in a test tube was vigorously shaken for 2 minutes, frothing was observed in each of roots dilute with ethyl acetate indicating the presence of saponins.



Figure 1: Flamboyant tree

Test for Glycosides

A 10cm³ of 5% H₂SO₄ was added to 1cm³ of each extract in a test tube. The mixture was heated in boiling water for 5 minutes. 10cm³ Fehling's solution. (5cm³ of each solution A and B) was added and boiled. A brick red precipitate indicating presence of glycosides was observed.

Test for Resins

A 5cm³ of copper was added to 5cm³ of each extract the resulting solution was shaken vigorously and allowed to separate. A green coloured precipitate indicating the presence of resins was noticed.

Test for Phlobatannins

A 5cm³ of distilled water was added to 5cm³ of each extract and boiled with 5cm³ of 1% HCl for 2 minutes, 5 no visible reaction was obtained and this indicating the absence of phlobatannins, except the extract of leaves diluted with ethanol which show presence of phlobatannins.

Test for Alkaloids

A 1cm³ of 1% HCl was added to 2cm³ of each extract in a test tube. Each extract was treated with few drops of Meyer's reagent. A creamy white precipitate was observed in extract of root dilute with ethanol and bark dilute with ethyl acetate which indicating presence of alkaloids.

Test for Flavonoids

A 2cm³ of the extract was heated with a few drops of concentrated HCl (Hydrochloric acid) no colouration was observed this indicate absent of flavonoids.

RESULTS AND DISCUSSION**Result**

Tables 1, 2, 3 show, the results of the phytochemical studies on the leaves, bark and roots extract of *Delonix regia*. In the table (+) sign indicates the presence of a particular constituent in low concentration, (+ +) indicates presence in moderate of a constituents (+ + +) in higher concentration, while (-) indicates the absence of a constituent.

The results show bioactive substances such as tannins, carbohydrates, saponins, glycosides, resins, phylobatanins, alkaloids, flavonoids. While tannins and resins were present in high concentration (+ + +), carbohydrate and saponins were moderately present (+ +), phlobatannins and saponins alkaloids were in low concentrations (+) while glycoside and flavonoids were absent (-).

Table 1: Phytochemical Analysis of the Leaves *Delonix regia*

ANALYSED CONSTITUENTS	REMARKS		
	Water	Ethanol	Ethyl Acetate
Carbohydrate	+ +	—	—
Tannins	+	+ + +	+ +
Glycoside	—	—	—
Saponins	+	—	—
Resins	+	+ + +	+ +
Phlobatannins	—	+	—
Flavonoids	—	—	—
Alkaloid	—	—	—



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Table 2: Phytochemical Analysis on the Bark of *Delonix regia*

ANALYSED CONSTITUENTS	REMARKS		
	Water	Ethanol	Ethyl Acetate
Carbohydrate	—	—	—
Tannins	—	—	—
Glycoside	—	—	—
Saponins	++	—	—
Resins	+	—	—
Phlobatannins	—	—	—
Flavonoids	—	—	—
Alkaloids	—	—	+

Table 3: Phytochemical Analysis on the Roots *Delonix regia*

ANALYSED CONSTITUENTS	REMARKS		
	Water	Ethanol	Ethyl Acetate
Carbohydrate	—	—	—
Tannins	—	—	—
Glycoside	—	—	—
Saponins	++	—	+
Resins	—	—	—
Phlobatannins	—	—	—
Flavonoids	—	—	—
Alkaloids	—	+	—

- +++ High concentration
 ++ Moderate concentration
 + Low concentration
 - Not detected.

Discussion

The values of bioactive substances present in *Delonix regia* such as tannins, carbohydrate, glycoside, resins, phlobatannins, flavonoids and alkaloids were closely related to those earlier reported by (Abulude *et al.*, 2001), on some woody plants such as *Mangifera indica*, *Tectona grandis*, *Cola nitida* etc.

It is suggested that the traditional medicinal use of *Delonix regia* should be continued and scientific evaluation of its active ingredients or constituents given serious consideration. This would involve elucidation and characterization of the bio – active ingredients or constituents responsible for the phytochemical properties. The inhibitory activities of these extracts give promise to their potential application in the treatments of microbial indeed ailments or diseased condition in agreement with traditional uses of the plants extracts.



CONCLUSION AND RECOMMENDATION

Conclusion

This research work has revealed potentials of *Delonix regia* plant in pharmacology as potential sources of useful drugs. This study therefore has provided some biochemical basic facts ethnos pharmacological uses of these plants in the treatment and prevention of various diseases and disorders.

Recommendation

Since the results of the phytochemical screening have shown that the extract of the leaves, bark and roots of *Delonix regia* contain, alkaloids, tannins, saponins, resins, carbohydrate and glycoside. Therefore, I recommend that these extracts should be used in the production of drugs in the areas of pharmaceutical or pharmacology for the treatment off intestinal tract, diarrhea, skin disease and it should be used as a source of pesticide and insecticide, also herbicide in the agricultural area so as to improve the yield of crops and reduce pests, weeds and other organisms which are competing with man.

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