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Review Article

A Review of *Aphanamixis polystachya* (stem bark): An Overview of its Biology, Traditional Uses, and Pharmacological Activities

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ABSTRACT

Aphanamixis polystachya (pithraj or amoorarohituka) belong to family Meliaceae (Neem family) these are native to aasam, (India), growing to 20-30 meter tall. It is one of the herb mentioned in all ancient Ayurveda. Different parts of the plant showed the presence of terpene, beta-sitosterol, alkaloid, glycoside, saponin, polystachin, chromone, triglyceride and flavonoids. Various studies indicate that it possesses anti-diabetic, anti- microbial, anti-tumor antioxidant, cytotoxicactivity various parts of the used in Indian traditional medicine because of their hepatoprotective, antibacterial, anthelmintic and anti-rheumatic properties. The bark is acrid, depurative and acts as urinary astringent.

INTRODUCTION

Aphanamixis polystachya it is commonly known as amoora, a member of the family of meliaceae. is native to tropical Asia It is distributed in Indian subcontinent, Bhutan, Sri Lanka, Indo-China, Myanmar, Thailand, Malaysia, Indonesia, Papua, New Guinea and Philippines.[1] Amoora tree has good medicinal value. The plant possesses antitumor, antimicrobial, hepatoprotective, insecticidal, depressant properties. Medicinal plant is frequently utilized to cure a variety of ailments in traditional cultures all around the world. There is plenty of traditional medicine

systems based on plants, including Ayurvedic (Indian), Unani (Arabian), and Chinese. Modern scientific studies have approved many of these traditional medicinal uses of plants by evaluating Phytochemistry and Pharmacological activities. *Aphanamixis polystachya*, also known as Amoora rohitukine is a medicinal plant belonging to the Meliaceace family.[2]

PHARMACOGNOSTIC PROFILE OF *APHANAMIXIS POLYSTACHYA*

Nature acts as a nice source of salvation for human being by providing different remedies from its

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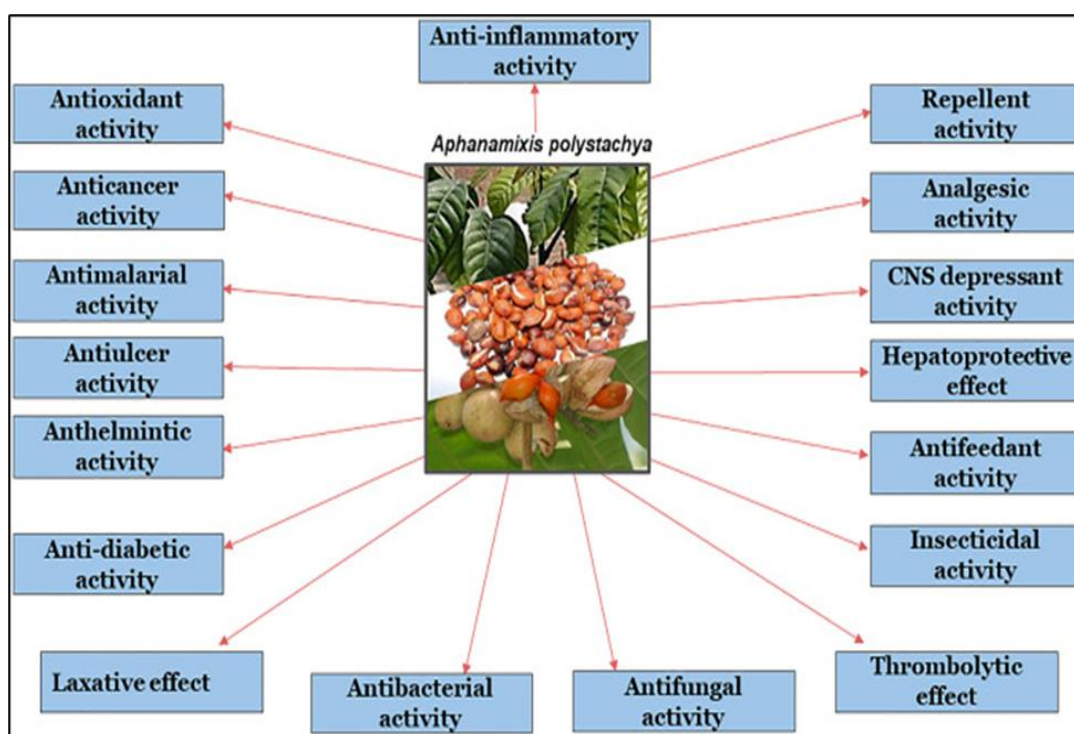


plants, animals and other sources to treat almost all ailments of mankind. Among the natural sources, medicinal plants are important contributors to the medicinal preparations as raw plant materials, refined crude extracts and mixtures etc. Several thousands of plants containing medicinal values have been identified for treating different ailments [3].

Even in this recent time, peoples are still depending on the traditional medicine for their primary health care.1 New drugs of plant derivation are so much crucial because they are cheap and have little side effects [4]. So medicinal

plants are essential. Report shows that more than 80% of the world's population still uses plants to maintain their health and to cure their ailments [5]. It has been studied that fruits and herbs containing phytochemicals and non-nutritive may protect human from a lot of diseases for their biological activities [5]. It is now established and fully believed that phytoconstituents obtained from the medicinal plants serve as major and active molecules in the modern medicines [6].

Aphanamixis polystachya (*A. polystachya*) belonging to the family Meliaceae is a traditional plant with potential medicinal uses.



Graphical represent of pharmacogenetic profile.

PLANT PROFILE



Figure No: *Aphanamixis polystachya* (Wall). Parker

Name: *Aphanamixis polystachya* (Wall.) R. Parker

Synonym: *Aglaia polystachya*,
Ricinocarpodendron polystachya

Family: meliaceous

Species: *polystachya*

Vernacular name: English -White Cedar,
Rohituka

Marathi-Rohida, Raktarohida Hindi- Harihara
Bengali- Pitraj, Tiktara

Telugu-Rohituka

Table no.3. Taxonomic Ranks of *Aphanamixis Polystachya*

Kingdom	Plantae
Order	Sapindales
Family	Meliaceae
Genus	<i>Aphanamixis</i>
Species	<i>Aphanamixis Polystachya</i>

Plant description⁷

Aphanamixis polystachya (wall.) parker belonging to Meliaceae family, a large evergreen tree found to grow in most of the hotter parts of India growing to 20-30 meter tall, Moderate to big sized tree grows up to 30 meters in height. Bark greyish brown to dark brown, rough, exfoliating in circular flakes, wood reddish brown, leaves large, imparipinnate.

Flower and fruit

Flower clusters occur in leaf axils less than a foot long. Flower are 6-7 mm in diameter, with 3 bracteoles. Flowers have 5 nearly circular sepals, the flowers may-September. The fruits are globular, smooth yellow when ripe.

Leaves stem and roots: -

Leaves are odd or even pinnate, 30-60cm long, with 9-21 leaflets are oblong- elliptic, or ovate, 17-26 × 4-10cm with basal pair smallest, leathery when mature, with visible transparent tiny spots under sunlight. Base of the leaflets is oblique, margin is entire

Chemical constituents:

The fruit shell contains triterpene, *Aphanamaxine*. The bark contains tetraterpene, *Aphanamaxine*. The leaves contain diterpene, alcohol, aphanomixol and β -sitosterol. The seeds yield a limonoid, Rohitukine, polystachya and others, an alkaloid, a glycoside and a saponin. A chromone and three flavonoids, glycosides have been reported from the roots. *Aphanamixis polystachya*, commonly known as 'rohitukine' contains many bioactive compounds including rohitukine, amooranin, aphanamines, *Aphanamaxine*, aphananoid, aphananin and others that can be used to treat various ailments.

Medicinal uses

Astringent, spleen and liver disease, tumor

Traditional uses

It is used as astringent, vulnerary, digestive, anthelmintic, depurative, ophthalmic and refrigerant. It is useful in spleen and liver disorders, tumors, ulcer, dyspepsia, intestinal worms, skin disease, leprosy, diabetes, ophthalmic jaundice, hemorrhoids, rheumatoid arthritis and leucorrhea.[8]

MATERIAL AND METHODS

The plant was purchased by Dr. K. Madhava Chetty from the Department of Botany Sri Venkateshwara University, Tirupati-517 502,

A.P., INDIA, & authenticated by Dr. K. Madhva Chetty from the Department of Botany Sri Venkateshwara University.

The specimen voucher number 0513.

Extraction of plant material of stem bark [9]

The dried plant of *Aphanamixis polystachya* were grounded to fine powder in an electric grinder. About 250gram of grinded powdered material were treated with petroleum ether in 24 hour and then filtered in filter paper and this powder are again dry then 200grams of powder was taken inside the Soxhlet apparatus that was suspended powdered above a 500ml of round bottom flask, containing about hydroalcoholic 7:3 proportion of water: ethanol below reflux condenser, the flask was heated using 500ml mantle-maintained temperature of above 60°C and until the 72 hours.

The mixture was filtered in stepwise processes. While volume is reduced, it was then poured in watch glass of large surface area to make it more condensed and allow the rest solvent to evaporate. While the condensed filtrate turned into A gummy concentrate, it was obvious that we found the crude hydroalcoholic extract.

The crude hydroalcoholic extract was further evaporated to dryness to obtain the dried hydroalcoholic extract. The extract was finally stored in air tight container in a dry and cool places & for further use in the experiment.



Soxhlet apparatus plant extraction



extract of *Aphanamixis Polystachya*

Preliminary Phytochemical screening

Small quantity of freshly prepared hydroalcoholic extract and different fractions of barks of *Aphanamixis polystachya* were subjected to preliminary phytochemical analysis for the detection of phytochemicals such as alkaloids with Mayer's and Hager's reagent, Carbohydrates with Benedict's test and Fehling's test, glycosides with Legal's test and Modified Borntrager's test, phytosterols with Salkowski's test and Liebermann Burchard's test, proteins with xanthoproteic test, flavonoids with alkaline reagent test and lead acetate test, tannins with gelatin test, saponins with Froth test and foam test, phenols with ferric chloride test[10]

Antioxidant activity

There are various well-known methods, which are followed to determine the antioxidant properties. Among them, two complementary test methods namely total phenolic content determination and DPPH free radical scavenging assay methods were used for investigating the antioxidant activity of *Aphanamixis polystachya*.

Antimicrobial activity

For the evaluation of antimicrobial activity, disc diffusion method is widely acceptable [11]. In this classical method, antibiotics were diffused from a reliable source through the nutrient agar and a concentration gradient was created. Dried, sterilized filter paper discs (6 mm diameter, HI-Media, China) containing the test samples of known amounts (400 µg/disc) were placed on nutrient agar medium consistently seeded with the test microorganisms. Standard antibiotic of ciprofloxacin (5 µg/disc) and blank discs were used as positive and negative control. For the maximum diffusion of the test materials to the surrounding media, these plates were kept at low

temperature (4 °C) for 24 h. Then the plates were incubated at 37 °C for about 24 h to allow optimum growth of the organisms. The test materials with antimicrobial property inhibited microbial growth in plates and thereby yielded a clear, distinct zone defined as zone of inhibition.[12]

DPPH scavenging activity

DPPH radical serves as the oxidizing radical to be reduced by the antioxidant (AH) and as the indicator for the reaction. The stable DPPH radical-scavenging activity was measured using the modified method. In this assay, 2 ml of 0.2 mM methanolic DPPH solutions was added to 2 ml of extract solution at different concentrations and the contents were stirred vigorously for 15 seconds. Then the solutions were allowed to stand at dark place at room temperature for 30 min for reaction to occur. After 30 min, absorbance was measured against a blank at 517 nm with a double beam UV/Visible spectrophotometer.

The percentage of DPPH radical-scavenging activity of each plant extract was calculated as DPPH radical-scavenging activity (%I),

$$= \frac{A_0 - A}{A_0} \times 100$$

Were,

A₀ is the absorbance of the control solution (containing all reagents except plant extracts); A is the absorbance of the DPPH solution containing plant extract. The DPPH radical-scavenging activity (%) was plotted against the plant extract concentration to determine the concentration of extract necessary to decrease DPPH radical-scavenging by 50% (called IC₅₀). The IC₅₀ value of each extract was estimated by sigmoid non-linear regression. These values were changed to antiradical activity, defined as 1/EC₅₀, since this



parameter increases with antioxidant activity. All determinations were performed in triplicate

Statistical Analysis

The results are expressed as mean $\pm$ SEM. Statistical comparisons were made using one-way ANOVA with Dunnett t test. Significance was set at $p < 0.05$. Dose dependencies were determined by the regression coefficient.

Pharmacological activity

Hepatoprotective activity

The liver is one of the important parts of the body, it is the largest gland of the body. It performs numerous essential functions as it regulates the blood volume and metabolism of nutrients such as carbohydrates, proteins, and lipids, and excretion of waste metabolites. Additionally, it also supervises the metabolism and excretion of drugs and other xenobiotics from the body, thereby providing safety against extraneous substances by depolluting and removing waste and toxic matter from the blood.

Signs and Symptoms of Liver Disorder

- Weight increases due to water retention
- Fatigue or loss of energy
- Weakness
- Jaundice
- Loss of appetite
- Enlarge liver
- Swelling of the feet
- Fluid collection in the abdomen, known as ascites

- Discolored bodily discharge (dark urine or light stools)
- Yellow skin
- Yellow eyes
- Nausea
- Vomiting
- Diarrhea
- Abdominal pain
- Abnormal bruising and bleeding.

Causes of liver Disease:

Liver disorder is the most common health hazard found in developing countries due to dietary habits, alcohol ingestion, poor hygiene, unsupervised drug use, and smoking, etc. Liver disease can be non-inflammatory, inflammatory, and degenerative. High levels of plasma total cholesterol (LDL-C) and triglycerides (TGs) are associated with a high risk of atherosclerosis and cardiovascular disease owing to hepatic insufficiency. Hepatotoxicity caused by many toxins Carbon Tetrachloride (CCl_4), thioacetamide, acute or chronic alcohol consumption, various infections like hepatitis ABCD and drugs, in which drugs are the most common offenders. Free radical generations in alcohol use result in the development of hepatitis, leading to Cirrhosis

Pathophysiology

Liver disorder can result from infections, drugs, toxins, ischemia, and autoimmune disorders. Chronic liver injury results in hepatocellular death, inflammation, activation of signaling pathways, and fibrogenesis. The mechanism of hepatotoxicity can vary depending on the specific



agent or toxin involved. Oxidative stress. Drug-induced hepatotoxicity: Drug-induced hepatotoxicity has been of increasing interest due to the withdrawal of several drugs shortly after being put into the market. Drug-induced liver injury is often life-threatening. Diagnosis of drug hepatotoxicity may sometimes be evident based on a temporal relationship between initiation of a drug followed by liver chemistry test evaluations, especially in the case of medications that are classically associated with drug hepatotoxicity.

Thioacetamide is a hepatotoxic agent and causes liver disorders. Hepatic microsomal cytochrome P450E converts thioacetamide to TAA-S-oxide (TASO) and then to toxic thioacetamide S-dioxide (TASO₂), which TASO₂ leads to liver cirrhosis. Thioacetamide is a sulfur group they perform to replaces of oxygen group and attaches to the sulfur and causing liver damage, which means liver fibrosis.

Pharmacological Treatment.

Pharmaceutical drugs in conjunction with antiviral therapy are typically used to treat herb-induced liver injury. For example, Hepatitis C virus is treated using a sustained virologic response, performed with ribavirin (RBV) and pegylated interferon (PegIFN) alpha via intravenous administration one time per week with 800 1400 mg per day for forty-eight weeks. Specific treatment is required to prevent fibrosis and further deterioration of liver function. For example, CLD due to copper accumulation improved by chelating agents. Venesection gives amelioration in genetic hemochromatosis, and the use of steroids and immunosuppressant agents stops the deterioration of autoimmune hepatitis. Orthotopic liver transplantation is the most radical and effective treatment.

RESULTS

1. Result of Preliminarily Phytochemical Screening

Table no 01: Result of phytochemical screening

Various phytochemicals	Test	Results
Carbohydrate	Molisch test	-
	Fehling test	+
	Benedicts test	+
Alkaloid	Dragendroffs test	+
	Mayer test	+
	Hager test	+
Flavonoid	Shinoda test	+
	Lead acetate test	+
Protein and amino acid	Xanthoproteic test	+
	Ninhydrin test	+
Phenolic	Ferric chloride	+
Diterpene	Copper acetate test	+
Tanin	Ferric chloride test	+

+ sign indicates present -ve sign indicates absent

The result of preliminary phytochemical screening of *Aphanamixis* shows that extract contains

saponins, phenols, flavonoids, diterpenes, and amino acids. Comparative DPPH radical scavenging activity of different extracts of the bark



of *A. polystachya* and standards of Ascorbic Acid (AA)

% inhibition of different solvent extract and standard

Concentration (µg/ml)	Methanolic Crude Extract	Carbon tetra Chloride Extract	Pet Ether Extract	Chloroform Extract	Aqueous Extract	Ascorbic Acid (Standard)
5	7.31	30.02	20.03	2.03	1.96	41.66
10	14.71	38.20	25.63	4.31	5.61	49.46
20	18.02	45.89	29.14	13.25	12.21	54.29
40	50.06	48.69	32.61	17.42	18.06	56.85
60	59.31	65.20	39.25	22.34	21.64	59.03
80	69.96	85.45	46.18	30.24	29.99	65.44
100	81.26	87.31	52.36	36.25	36.25	72.29
250	83.21	95.81	65.31	51.64	51.64	83.96
500	92.99	97.30	82.54	80.32	70.56	97.40
IC ₅₀ (µg/ml)	44.43	19.86	82.69	193.28	233.17	14.52

2. ANTIMICROBIAL ACTIVITY

The antimicrobial potency of the test agents is measured by their activity to prevent the growth of the microorganisms (at concentrations of 400 µg/disc.) surrounding the discs which gives clear zone of inhibition. After incubation, the antimicrobial activities of the test materials such as methanolic crude extract of *A. polystachya* (MEAP), pet ether fraction of *A. polystachya* crude extract (PEAP), chloroform fraction of *A. polystachya* crude extract (CAP), carbon tetra chloride fraction of *A. polystachya* crude extract (CTAP) and aqueous fraction of *A. polystachya* crude extract (APCE).

DISCUSSION

Medicinal plants containing phytochemicals are well known because they show a variety of pharmacological actions in human body and in our study preliminary phytochemical screening

showed the presence of various phytochemicals. The presence of polyphenolic compounds such as flavonoids and tannins is responsible for antioxidant activity of the extracts. In this investigation the extract of the plant showed moderate antioxidant activities with an IC₅₀ which were compared with the values of standard drugs used. Antioxidant activities of different extracts of the bark of *A. polystachya* were found to increase with the increasing concentration. This plant is a good source of total phenolic content. It also contains moderate DPPH scavenging activity although carbon tetra chloride soluble fraction showed highest free radical scavenging activity. The effect of antioxidants of plant on DPPH is thought to be due to their hydrogen donating ability. Therefore, the extracts of this plant could be used potentially for the prevention of free radical-mediated diseases. Since the present study showed the presence of various bioactive secondary metabolites such as tannins, flavonoids,



saponin and alkaloids, that singly or in combination may be responsible for the defense mechanism against microorganisms and insects. For this reason, methanolic extract contains significant antimicrobial activity. Platelets play an important role in the process of formation of thrombus on the endothelial surface. Several thrombolytic agents are used to dissolve the clots that have already formed in the blood vessels; but these drugs have some limitations which can lead to serious and sometimes fatal consequences. In the present study, the plant extracts showed significant thrombolytic activity compared to negative control. This thrombolytic activity may be due to the fact that the extracts are good sources of alkaloids, flavonoids, tannins and terpenoids which are said to exert clot lysis.

CONCLUSION

In the context of the above discussion, it can be revealed that the extracts of bark of *A. polystachya* showed nice antioxidant activity. These extracts also possess significant antimicrobial and clot lysis activity. However, further investigations, based on these preliminary studies are required to explore the bioactive molecules which are responsible for the extracts' activities as well as their mechanisms of action.

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