



Studies on Phytochemical Analysis of Some Medicinal Plants

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ABSTRACT

The aim of this study was to identify the phytochemicals and to estimate the total phenolic and flavonoid content in selected medicinal plants such as *Murraya koenigii* (L.), *Pongamia pinnata* (L.), *Psidium guajava* (L.), *Azadirachta indica* (L.), and *Ocimum sanctum* (L.) Preliminary phytochemical screening of the aqueous extracts showed the presence of important bioactive compounds including alkaloids, tannins, saponins, flavonoids, terpenoids, proteins, and carbohydrates in all five plants. The presence of these phytochemicals indicates that the antioxidant properties of medicinal plants which are rich in phenolic compounds. Tannins bind to proline rich protein and interfere with protein synthesis. The plant extracts were also revealed to contain saponins which are known to produce inhibitory effect on inflammation. Medicinal plants are known to be rich sources of natural compounds with various therapeutic properties such as anti-plasmodic, antibacterial, anticancer, and wound-healing activities. In the present study, extracts were prepared from *Murraya koenigii* (L.), *Pongamia pinnata* (L.), *Psidium guajava* (L.), *Azadirachta indica* (L.), and *Ocimum sanctum* (L.) The high levels of alkaloids, flavonoids, and terpenoids suggest that these plants possess good antioxidant activity, which supports their traditional therapeutic use and potential application in drug development. Previous studies also confirm that these phytochemicals contribute to the medicinal and physiological properties of plants used to treat various diseases. The findings of this study suggest that these plant extracts can be considered valuable natural sources for the development of effective drugs. Further research is recommended to isolate and characterize the active compounds and to understand the mechanisms responsible for their biological activities. The results of this study suggest that the identified phytochemicals may be the bioactive compounds responsible for the medicinal properties of these plants, indicating that they are a valuable source of therapeutically important bioactive substances.

Keywords: Anti-plasmodics, Phytochemical, Therapeutic, Alkaloids,

INTRODUCTION

Phytochemicals are bioactive chemical compounds that come from plants. They are also called secondary metabolites. Plants produce two types of metabolites: primary metabolites and secondary metabolites (Altemimi, *et al.* 2022). Primary metabolites are necessary for the

normal growth and development of plants. Secondary metabolites are not directly needed for growth, but they help plants protect themselves from diseases, pests, and environmental stress (Zhang *et al.* 2021). Medicinal plants contain important organic compounds that produce specific effects on the human body. These bioactive compounds include tannins, alkaloids, carbohydrates, terpenoids, steroids, and flavonoids. These substances are produced during plant metabolism. Secondary metabolites are chemically diverse compounds and are widely used in medicine, veterinary science, agriculture, and research. Phytochemicals have many pharmacological and biological activities (Kumar *et al.* 2021). They act as antioxidants and help protect the body from diseases such as coronary heart disease and cancer. Many of them also show anti-carcinogenic, anti-mutagenic, antimicrobial, anti-inflammatory, and hepatoprotective properties. Plants are considered a valuable source of medicines. They are easily available, less expensive, generally safe, and usually have fewer side effects compared to synthetic drugs. For thousands of years, medicinal plants have been used in traditional systems of medicine. Even today, they are being studied for the development of new drugs such as anticancer, antimicrobial, and antihepatotoxic medicines.

According to the World Health Organization (WHO), medicinal plants are one of the best sources for obtaining a variety of drugs (WHO, 2023). Around 80% of people in developing countries depend on traditional medicine for primary health care, and many of these medicines are derived from plants. However, scientific investigation is necessary to understand their safety, effectiveness, and chemical composition. Plant materials such as bark, leaves, flowers, roots, fruits, and seeds are commonly used in herbal medicine. Studying the chemical constituents of plants is important because it helps in identifying active compounds and developing new medicines.

Murraya koenigii

Murraya koenigii, commonly known as Curry leaf or "Curry patta," belongs to the Rutaceae family. It is widely used in Indian cooking as a flavouring agent and also has medicinal importance. The leaves contain vitamins such as Vitamin A, B, C, and E. The plant has antioxidant, antimicrobial, anti-inflammatory, and mosquitocidal properties (Verma *et al.* (2021). The antioxidant activity is mainly due to the presence of

phenols and flavonoids. These compounds help in reducing oxidative stress by neutralizing free radicals. The plant also contains saponins, tannins, and flavonoids, which contribute to its antibacterial and protective effects.

Pongamia pinnata

Pongamia pinnata belongs to the Fabaceae family. It is commonly known as Karanja in Hindi and Indian beech in English. It is widely found in India, Australia, Bangladesh, and China. This plant has been used in traditional systems of medicine such as Ayurveda and Siddha for treating various diseases. It contains several phytochemicals including alkaloids, flavonoids, tannins, glycosides, karangin, glabrin, kanugin, and fixed oils. The plant shows anti-inflammatory, antioxidant, anti-diarrhoeal, antifungal, antiplasmodial, anti-ulcer, anti-hyperglycaemic, and analgesic activities. The seeds contain about 28–34% oil and are also considered a potential source of biodiesel (Rao *et al.*, 2022).

Psidium guajava

Psidium guajava, commonly known as Guava, is a small tree that grows up to 20 feet in height. It has smooth, thin, copper-coloured bark that peels off easily. Guava is native to Mexico and is widely distributed in South America, Europe, Africa, and Asia. In India, it is commonly found in Uttar Pradesh, Bihar, Maharashtra, Assam, West Bengal, Haryana, and Andhra Pradesh. Guava is used in traditional medicine for its medicinal properties. It is rich in bioactive compounds that contribute to its therapeutic value. (Joseph and Priya, 2022).

Azadirachta indica

Azadirachta indica, commonly known as Neem, is an evergreen tropical tree belonging to the Meliaceae family. It is native to India and grows widely in tropical and subtropical regions. The tree can grow up to 20–30 meters in height. Neem is well known for its medicinal value. It has antimicrobial, antifungal, antiviral, anti-inflammatory, and antioxidant properties. Due to its wide range of therapeutic uses, neem is commonly used in herbal remedies and plant-based medicines (Islas *et al.* 2021)

Ocimum sanctum

Ocimum sanctum, commonly known as Tulsi or Holy Basil, belongs to the Lamiaceae family. It is an important medicinal herb widely used in traditional

medicine. It contains many secondary metabolites and essential oils. Tulsi is used in the treatment of malaria, diarrhoea, bronchial asthma, dysentery, bronchitis, skin diseases, arthritis, eye disorders, and chronic fever. It also shows anticancer, antifungal, antimicrobial, antifertility, hepatoprotective, antispasmodic, cardioprotective, antiemetic, antidiabetic, analgesic, adaptogenic, and diaphoretic properties (Prakash and Gupta, 2022). The present study focuses on the extraction and preliminary phytochemical analysis of *Ocimum sanctum* leaves.

Quality Control of Medicinal Plants

Quality of a medicinal plant product is determined by its identity, purity, chemical content, and safety. Quality control ensures that the plant material meets proper standards before it is used in medicine. Traditional knowledge combined with modern scientific methods helps in assessing the quality, safety, and effectiveness of herbal medicines.

MATERIALS AND METHODS

Collection of plant materials

Fresh leaves of *Murraya koenigii*, *Pongamia pinnata*, *Psidium guajava*, *Azadirachta indica*, *Ocimum sanctum*, and were collected for the study. The collected plant materials were shade-dried at room temperature until complete removal of moisture. The dried leaves were then crushed into fine powder using a mechanical blender. The powdered samples were stored in airtight, properly labelled containers and preserved for further experimental analysis.

Preparation of plant extracts

Hot water extraction

Five grams (5 g) of the dried and finely powdered plant material was weighed and transferred into a clean beaker. To this, 200 ml of distilled water was added. The mixture was heated on a hot plate at a temperature of 30–40°C for 20 minutes with continuous stirring to ensure proper extraction of phytoconstituents. After heating, the extract was allowed to cool and then filtered through Whatman filter paper. The filtrate obtained was used for preliminary phytochemical analysis. The prepared extract was stored under refrigeration until further use.

Test for Proteins

Millon's Test- (2 ml) of Millon's reagent was added to the crude extract. A white precipitate was formed,

which turned red on gentle heating. This confirmed the presence of proteins.

Ninhydrin Test- The crude extract was boiled with 2 ml of 0.2% ninhydrin solution. The appearance of a violet colour indicated the presence of amino acids and proteins.

Test for Carbohydrates

Fehling's Test- Equal amounts of Fehling's A and Fehling's B solutions were mixed together. Then, 2 ml of this mixture was added to the crude extract and gently boiled. The formation of a brick-red precipitate at the bottom of the test tube indicated the presence of reducing sugars.

Benedict's Test- (2 ml) of Benedict's reagent was added to the crude extract and boiled. The formation of a reddish-brown precipitate showed the presence of carbohydrates.

Molisch's Test- (2 ml) of Molisch's reagent was added to the crude extract and mixed well. Then, 2 ml of concentrated sulfuric acid (H_2SO_4) was carefully added along the side of the test tube. The appearance of a violet ring at the junction of the two layers confirmed the presence of carbohydrates.

Iodine Test (Test for Carbohydrates)- (2 ml) of iodine solution was added to the crude extract. The appearance of a dark blue or purple colour indicated the presence of carbohydrates (starch).

Test for Phenols and Tannins- (2 ml) of 2% ferric chloride ($FeCl_3$) solution was added to the crude extract. The formation of a blue-green or black colour indicated the presence of phenols and tannins.

Test for Flavonoids

Shinoda Test- A few small pieces of magnesium ribbon were added to the crude extract. Then, concentrated hydrochloric acid (HCl) was added drop by drop. The appearance of a pink or red colour after a few minutes confirmed the presence of flavonoids.

Test for Saponins- (5 ml) of distilled water was added to the crude extract in a test tube. The mixture was shaken vigorously. The formation of stable foam indicated the presence of saponins.

Test for Glycosides

Salkowski's Test- (2 ml) of chloroform was added to the crude extract. Then, 2 ml of concentrated sulfuric acid (H_2SO_4) was carefully added and the mixture was gently shaken. The appearance of a reddish-brown colour indicated the presence of a steroidal ring (glycoside component).

Keller-Kiliani Test- (2 ml) of glacial acetic acid containing 1–2 drops of 2% ferric chloride ($FeCl_3$) solution was added to the crude extract. This mixture was carefully poured into another test tube containing 2 ml of concentrated sulfuric acid (H_2SO_4). The formation of a brown ring at the junction of the two layers indicated the presence of cardiac glycosides.

Test for Steroids- (2 ml) of chloroform was added to the crude extract. Then, concentrated sulfuric acid (H_2SO_4) was added along the side of the test tube. A red colour in the lower chloroform layer indicated the presence of steroids. In another method, 2 ml of chloroform was added to the crude extract, followed by 2 ml each of concentrated sulfuric acid (H_2SO_4) and acetic acid. The appearance of a greenish colour confirmed the presence of steroids.

Test for Terpenoids-The crude extract was dissolved in 2 ml of chloroform and allowed to evaporate to dryness. Then, 2 ml of concentrated sulfuric acid (H_2SO_4) was added and heated for about 2 minutes. The development of a greyish colour indicated the presence of terpenoids.

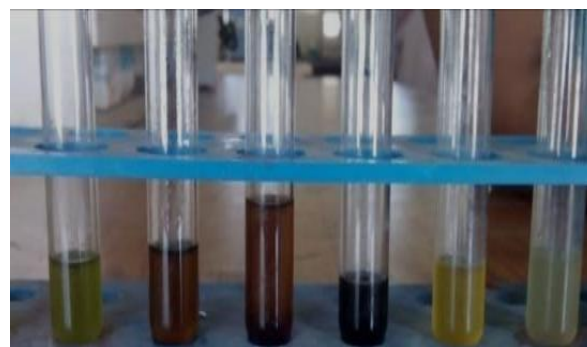
Test for Alkaloids- (2 ml) of 1% hydrochloric acid (HCl) was added to the crude extract and gently heated. Then, Mayer's reagent and Wagner's reagent were added separately. The formation of turbidity or a precipitate indicated the presence of alkaloids.

Observation Table:

Phytochemical constituents of Five medicinal plants studied.

Table 1: Phytochemical Analysis test of/*Murraya koenigii*

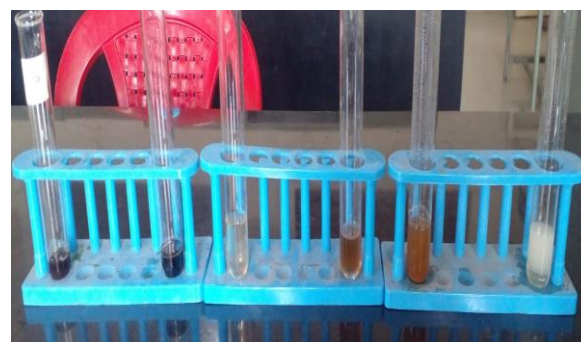
Sr. no	Phytochemical	Result
1	Glycosides	++
2	Resins	++
3	Flavonoids	--
4	Steroid	+
5	Tannin	++



Murraya koenigii phytochemical test photograph

Table 2: Phytochemical tests of *Pongamia pinnata* Linn.

Sr. No	Phytochemical	Result
1	Phenol	--
2	Terpenoids	++
3	Flavonoids	+
4	Saponin	+
5	Tannin	++



Pongamia pinnata phytochemical test photograph

Table.3: Phytochemical Analysis test of *Psidium guajava*

Sr.no	Phytochemical	Result
1	Glycosides	--
2	Reducing sugar	++
3	Flavonoids	++
4	Steroid	+
5	Tannin	++



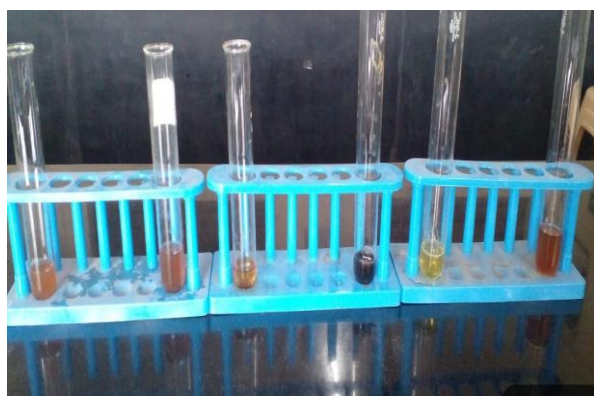
Psidium guajava phytochemical test photograph

Table.4: Phytochemical Analysis test of *Azadirachta indica*

Sr.no	Phytochemical	Result
1	Glycosides	+
2	Reducing sugar	++
3	Flavonoids	++
4	Steroid	+
5	Tannin	++

*Azadirachta indica* phytochemical test photographTable.5: Phytochemical Analysis test of *Ocimum sanctum*

Sr.no	Phytochemical	Result
1	Glycosides	+
2	Reducing sugar	++
3	Flavonoids	++
4	Steroid	+
5	Tannin	++

*Ocimum sanctum L* phytochemical test photograph

RESULTS

The phytochemical properties of the five medicinal plants are shown in Tables 1, 2, 3, 4, and 5. The results show that all five plants contain important medicinal compounds. These include proteins, carbohydrates, phenols, tannins, flavonoids, and saponins. Glycosides were not found only in the leaves of *Psidium guajava*. Steroids were absent only in the leaves of *Pongamia pinnata*. Terpenoids were not present in the leaves of *Ocimum sanctum*. Many previous studies have

confirmed that these phytochemicals give medicinal and physiological benefits to plants and help in treating various diseases. Therefore, extracts from these plants can be considered good sources for developing useful medicines. The use of these plants in traditional medicine is strongly recommended. However, further research is needed to isolate, purify, and identify the active compounds responsible for their medicinal effects. More studies should also be done to understand how these plant extracts work in the body.

Conflict of interest

The authors declare no competing interests.

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