Asian Journal of Innovative Research. (2024): 8(4)

ISSN 2455 7285

Article Chemistry

PHYTOCHEMICAL ANALYSIS OF *Aegle marmelos* LEAVES

T. ABARNA
Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

Received on July 2024 **Revised on Aug. 2024** **Online Nov. 2024**

INTRODUCTION

Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans further than those attributed to macronutrients and micronutrients (Hasler and Blumberg,1999). They protect plants from disease and damage and contribute to the plant‟s color, aroma and flavor. In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are called as phytochemicals (Mathai, 2000). Recently, it is clearly known that they have roles in the protection of human health, when their dietary intake is significant. More than 4,000 phytochemicals have been cataloged and are classified by protective function, physical characteristics and chemical characteristics (Meagher and Thomson, 1999). Plant-derived substances have recently become of great interest owing to their versatile applications. Medicinal plants are the richest bio-resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs.

The secondary metabolites formed also are an important trait for our food plants (taste, colour, scent, etc.) and ornamental plants. Moreover, numerous plant secondary metabolites such as flavonoids, alkaloids, tannins, saponins, steroids, anthocyanins, terpenoids, rotenoids etc. have found commercial application as drug, dye, flavour, fragrance, insecticide, etc. Such fine chemicals are extracted and purified from plant materials. Plant produces these chemicals to protect itself but recent research demonstrates that many phytochemicals can protect humans against diseases including cancer, cardiovascular, arthritis, diabetic, aging etc (Velavan, 2011). The techniques application of chromatography, mass spectrometry, infrared spectrometry, and nuclear magnetic resonance allowed quantitative and qualitative measurements of a large number of plant metabolites (Velavan, 2015).

Phytochemical screenings are preliminary tests conducted to detect the presence of both primary and secondary metabolites in an extract. Several qualitative analyses described below have been used to detect the presence of secondary metabolite like alkaloids, flavonoids, tannins, saponins, flavones, sterols, terpenes, cardiac glycosides while primary metabolites like protein, carbohydrates, and fats (Pandey and Tripathi, 2014; Beena *et al.*, 2016; Trease and Evans, 1989). This internship mainly deals with the general techniques involved in phytochemical analysis from plant source. The chosen plant was *Aegle marmelos* (Tamil name: வில்வம்) leaves.

TECHNIQUES AND OBSERVATION

Organoleptic character refers to evaluation each of the powdered traditional medicinal plant by colour, odour, taste, texture and shape (Koroma *et al.*, 2022). These criteria therefore should be considered aspects of raw material 'quality'. The responses for organoleptic characters are given in Table 1. The comparative study for organoleptic parameters such as color, taste, odour, texture and shape which confirm the overall acceptability

Table 1: Organoleptic Characters of herbal

Characters	Results
Colour	Ash
Odor	Characteristic smell
Taste	Bitter
Texture	Fine powder
Shape	Granule

Phytochemicals extraction and identification

The leaves powder of *Aegle marmelos* were purchased in June 2024 from Thanjavur district, Tamil Nadu, India. 1 gram of the powder transferred in to different conical flask (250ml). The conical flask containing 50ml of hydro-ethanol solvent. The conical flask containing sample were shaken well for 30 minutes by free hand. After 24 hrs, the extracts were filtered using Whatman filter paper No.1 and filtrate is used for further analysis. Chemical tests were carried out on the extract using standard procedures to identify the constituents as described by Harborne (1973 and 1976). Table 2 shows the presence of phytochemicals in hydro-ethanolic extract (Plate 1) and significant amounts of total phenol (370.00 mg/gm) and flavonoids (60 mg/gm) were repented.

Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	+
Saponin	+
Flavonoids	++
Steroids	+
Terpenoids	++
Alkaloids	-
Antroquinone	+
Polyphenol	++
Glycoside	+
Coumarins	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Plate 1: Qualitative screening of phytochemicals

Histochemical analysis

Histochemical analysis of plant powder were investigated. The different reagents treated with plant powder and observed under microscope. The histochemicals results revealed the presence of tannin, flavonoids, polyphenol, Steroids and terpenoids in plant. In this results further confirmed the presence of phytochemicals in plant (Table 3 and Plate 2).

Table 3: Histochemical analysis

S. No	Phytochemicals	Results
1	Tannin	+
2	Flavonoids	++
3	Steroids	+
4	Terpenoids	++
5	Polyphenol	++

(+) Indicates Presence; (++) Moderately present

Tannin

Flavonoids

Steroids

Polyphenol

Terpenoids

Plate 2: Histochemical analysis

Fluorescence analysis

Fluorescence analysis of entire of plant has been carried out in daylight and under UV light (Kokashi *et al.*, 1957). Fluorescence analysis of powder of plant was carried out by the treatment of different chemical reagents such as H_2O, H_2SO_4, HCl, NH_3, HNO_3, CH_3OH and NaOH. The fluorescence color shows specificity for each compound. It acts as a preliminary pharmacognostic parameter for identification and standardization of a particular drug from its adulterants. The Fluorescence behavior presence of the major bioactive compounds in the crude plant was found to be phenols, flavonoids, steroids and Coumarins (Table 4).

Table 4: Fluorescence analysis

S. No	Test	Colour observation		
		Visible Light	Short UV Light (254 nm)	Long UV Light (365 nm)
1	Plant powder	Light yellow	Light green	Brown
2	Plant powder treated with distilled water	Brown	Brown	Black
3	Plant powder treated with Hexane	Light green	Light green	Black
4	Plant powder treated with Chloroform	Light green	Light green	Black
5	Plant powder treated with Methanol	Light green	Brown	Black
6	Plant powder treated with Acetone	Light green	Light green	Black
7	Plant powder treated with 1N Sodium Hydroxide	Brownish black	Yellowish green	Brown
8	Plant powder treated with 1N HCL	Light green	Light green	Black
9	Plant powder treated with sulphuric acid with equal volume of water	Dark green	Green	Black
10	Plant powder treated with HNO_3 diluted with an equal volume of water	Yellowish orange	Yellowish green	Brown

Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of flavonols, Carotenoids, Terpenoids and Chlorophylls.

Table 5: Ultraviolet-visible spectroscopy analysis

Wavelength (nm)	*Compound identified (Harborne, 1973)
360	Flavonoids
400	Carotenoids
490	Terpenoids
640	Chlorophylls

Detection of functional groups

Functional groups were detection by the method of Ahluwalia and Dhingra, (2004). A functional group is a group of atoms or bonds inside a substance that is responsible for the substance's unique chemical reactions. Qualitative functional groups analysis is used to determine the functional groups of in a molecule. This study was carried out to screen qualitative analysis of functional group present in the plant extract of plant. Table 6 represent the qualitative a functional groups analysis in plant.

Table 6: Analysis of functional groups

S. No	Functional groups	Results
1	Alcohols	+
2	Phenol	+
3	Aliphatic amines	+
4	Aldehydes	+
5	Ketones	+
6	Carboxylic acids	+

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Thin Layer Chromatography (Harborne, 1973).

Thin layer Chromatography is based upon the principles of column and partition Chromatography. A thin layer of the stationary phase is formed on a suitable flat surface, such as glass and plastic plate. Separation of a mixture in this case is achieved over a thin layer of alumina or silica gel to which they are absorbed by different physical forces. TLC plate prepared according to the standard procedure. (Harborne, 1973; Stahl, 1969). The presences of phytochemicsl in the extracts were detected by TLC using suitable spraying reagents. Detection of spots by using spraying reagents Colored substances can be seen directly when viewed against the stationery phase whilst colorless species were detected by spraying the plate with appropriate reagent, which produced coloured areas in the regions, which they occupy (Harborne, 1973). The TLC report showed in the Plate 3 (Rf = 0.94).

Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Aegle marmelos* leaves contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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Article Chemistry

PHYTOCHEMICAL PROFILE OF *Centella asiatica*

ALSHEIK FARIS B

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

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Phytochemical screenings are preliminary tests conducted to detect the presence of both primary and secondary metabolites in an extract. Several qualitative analyses described below have been used to detect the presence of secondary metabolite like alkaloids, flavonoids, tannins, saponins, flavones, sterols, terpenes, cardiac glycosides

while primary metabolites like protein, carbohydrates, and fats (Pandey and Tripathi, 2014; Beena *et al.*, 2016; Trease and Evans, 1989). This internship mainly deals with the general techniques involved in phytochemical analysis from plant source. The chosen plant was *Centella asiatica* (Tamil name: வல்லாரை) leaves.

TECHNIQUES AND OBSERVATION

Organoleptic character refers to evaluation each of the powdered traditional medicinal plant by colour, odour, taste, texture and shape (Koroma *et al.*, 2022). These criteria therefore should be considered aspects of raw material 'quality'. The responses for organoleptic characters are given in Table 1. The comparative study for organoleptic parameters such as color, taste, odour, texture and shape which confirm the overall acceptability

Table 1: Organoleptic Characters of herbal

Characters	Results
Colour	Dark green
Odor	Characteristic smell
Taste	Bitter
xture	Fine powder
pe	Uneven crystal

Phytochemicals extraction and identification

The leaves powder of *Centella asiatica* were purchased in June 2024 from Thanjavur district, Tamil Nadu, India. 1 gram of the powder transferred in to different conical flask (250ml). The conical flask containing 50ml of hydro-ethanol solvent. The conical flask containing sample were shaken well for 30 minutes by free hand. After 24 hrs, the extracts were filtered using Whatman filter paper No.1 and filtrate is used for further analysis. Chemical tests were carried out on the extract using standard procedures to identify the constituents as described by Harborne (1973 and 1976). Table 2 shows the presence of phytochemicals in hydro-ethanolic extract (Plate 1) and significant amounts of total phenol (242.32 mg/gm) and flavonoids (10 mg/gm) were repented.

Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	++
Saponin	++
Flavonoids	++
Steroids	++
Terpenoids	++
Alkaloids	++
Antroquinone	++
Polyphenol	++
Glycoside	++
Coumarins	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

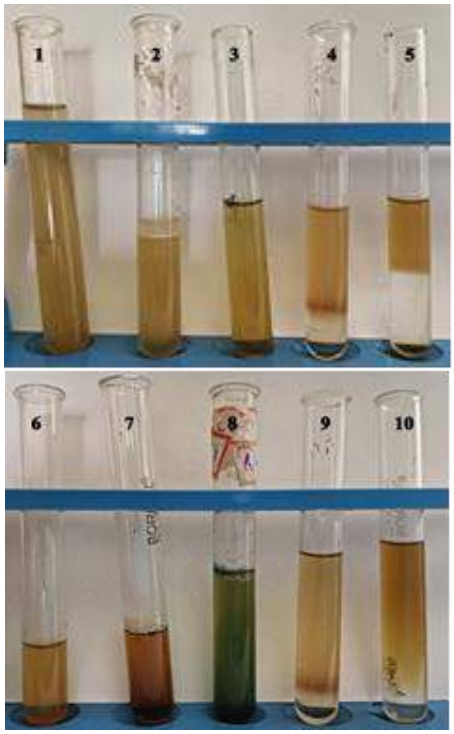

Plate 1: Qualitative screening of phytochemicals

Histochemical analysis

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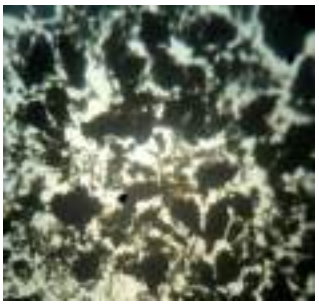

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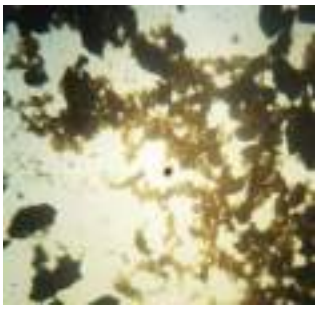
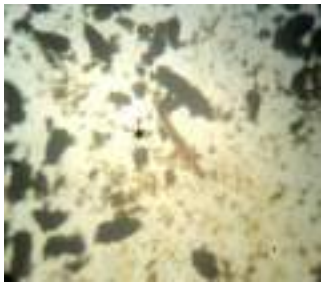
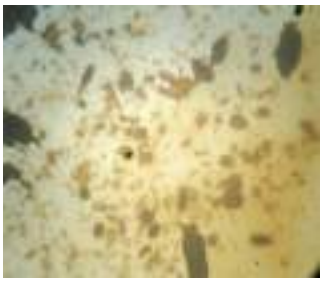


Tannin



Polyphenol

Terpenoids



Steroids

Plate 2: Histochemical analysis

Fluorescence analysis

Fluorescence analysis of entire of plant has been carried out in daylight and under UV light (Kokashi *et al.*, 1957). Fluorescence analysis of powder of plant was carried out by the treatment of different chemical reagents such as H_2O, H_2SO_4, HCl, NH_3, HNO_3, CH_3OH and NaOH. The fluorescence color shows specificity for each compound. It acts as a preliminary pharmacognostic parameter for identification and standardization of a particular drug from its adulterants. The Fluorescence behavior presence of the major bioactive compounds in the crude plant was found to be phenols, flavonoids, steroids and Coumarins (Table 4).

Table 4: Fluorescence analysis

S. No	Test	Colour observation		
		Visible Light	Short UV Light (254 nm)	Long UV Light (365 nm)
1	Plant powder	Brownish green	Green	Dark brown
2	Plant powder treated with distilled water	Brownish yellow	Brownish green	Brownish green
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4	Plant powder treated with Chloroform	Brown	Brown	Black
5	Plant powder treated with Methanol	Dark brown	Dark brown	Black

6	Plant powder treated with Acetone	Dark brown	Dark brown	Black
7	Plant powder treated with 1N Sodium Hydroxide	Brown	Brownish green	Dark brown
8	Plant powder treated with 1N HCL	Brownish green	Brownish green	Dark brown
9	Plant powder treated with sulphuric acid with equal volume of water	Brownish yellow	Brownish green	Black
10	Plant powder treated with HNO_3 diluted with an equal volume of water	Brownish yellow	Brownish green	Black

Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of Flavonoids, Tannin and Chlorophylls.

Table 5: Ultraviolet-visible spectroscopy analysis

Wavelength (nm)	*Compound identified (Harborne, 1973)
340	Flavonoids
400	Tannin
640	Chlorophyll

Detection of functional groups

Functional groups were detection by the method of Ahluwalia and Dhingra, (2004). A functional group is a group of atoms or bonds inside a substance that is responsible for the substance's unique chemical reactions. Qualitative functional groups analysis is used to determine the functional groups of in a molecule. This study was carried out to screen qualitative analysis of functional group present in the plant extract of plant. Table 6 represent the qualitative a functional groups analysis in plant.

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3	Aliphatic amines	++
4	Aldehydes	++
5	Ketones	++
6	Carboxylic acids	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Thin Layer Chromatography (Harborne, 1973).

Thin layer Chromatography is based upon the principles of column and partition Chromatography. A thin layer of the stationary phase is formed on a suitable flat surface, such as glass and plastic plate. Separation of a mixture in this case is achieved over a thin layer of alumina or silica gel to which they are absorbed by different physical forces. TLC plate prepared according to the standard procedure. (Harborne, 1973; Stahl, 1969). The presences of phytochemicsl in the extracts were detected by TLC using suitable spraying reagents. Detection of spots by using spraying reagents Colored substances can be seen directly when viewed against the stationery phase whilst colorless species were detected by spraying the plate with appropriate reagent, which produced coloured areas in the regions, which they occupy (Harborne, 1973). The TLC report showed in the Plate 3 (Rf = 0.88).

Plate 3: Thin Layer Chromatography

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Article Chemistry

PHYTOCHEMICAL CHARACTERIZATION OF *Azadirachta indica*

BALAJI A

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

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TECHNIQUES AND OBSERVATION

Organoleptic character refers to evaluation each of the powdered traditional medicinal plant by colour, odour, taste, texture and shape (Koroma *et al.*, 2022). These criteria therefore should be considered aspects of raw material 'quality'. The responses for organoleptic characters are given in Table 1. The comparative study for organoleptic parameters such as color, taste, odour, texture and shape which confirm the overall acceptability

Table 1: Organoleptic Characters of herbal

Characters	Results
Colour	Yellowish brown
Odor	Sulfur smell
Taste	Bitter
Texture	Fine powder
shape	Uneven crystal

Phytochemicals extraction and identification

The leaves powder of *Azadirachta indica* were purchased in June 2024 from Thanjavur district, Tamil Nadu, India. 1 gram of the powder transferred in to different conical flask (250ml). The conical flask containing 50ml of hydro-ethanol solvent. The conical flask containing sample were shaken well for 30 minutes by free hand. After 24 hrs, the extracts were filtered using Whatman filter paper No.1 and filtrate is used for further analysis. Chemical tests were carried out on the extract using standard procedures to identify the constituents as described by Harborne (1973 and 1976). Table 2 shows the presence of phytochemicals in hydro-ethanolic extract (Plate 1) and significant amounts of total phenol (279.34 mg/gm) and flavonoids (160 mg/gm) were repented.

Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	++
Saponin	++
Flavonoids	++
Steroids	++
Terpenoids	++
Alkaloids	-
Antroquinone	+
Polyphenol	++
Glycoside	+
Coumarins	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

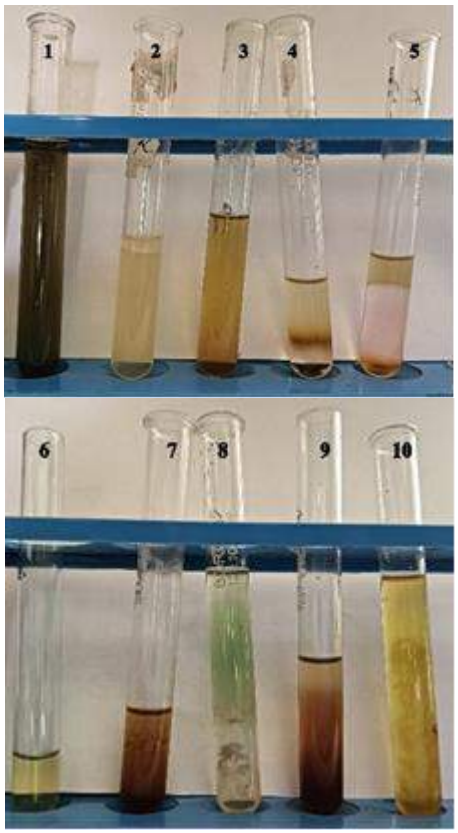


Plate 1: Qualitative screening of phytochemicals

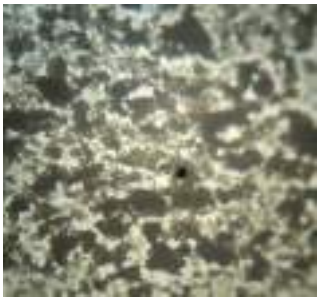
Histochemical analysis

Histochemical analysis of plant powder were investigated. The different reagents treated with plant powder and observed under microscope. The histochemicals results revealed the presence of tannin, flavonoids, polyphenol, Steroids and terpenoids in plant. In this results further confirmed the presence of phytochemicals in plant (Table 3 and Plate 2).

Table 3: Histochemical analysis

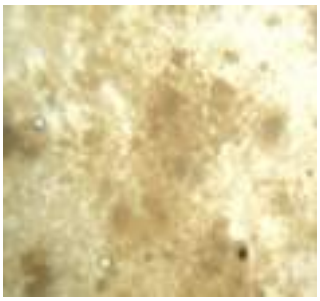
S. No	Phytochemicals	Results
1	Tannin	++
2	Flavonoids	++
3	Steroids	+
4	Terpenoids	+
5	Polyphenol	++

(+) Indicates Presence; (++) Moderately present



Tannin

Flavonoids



Steroids

Polyphenol

Terpenoids

Plate 2: Histochemical analysis

Fluorescence analysis

Fluorescence analysis of entire of plant has been carried out in daylight and under UV light (Kokashi *et al.*, 1957). Fluorescence analysis of powder of plant was carried out by the treatment of different chemical reagents such as H_2O, H_2SO_4, HCl, NH_3, HNO_3, CH_3OH and NaOH. The fluorescence color shows specificity for each compound. It acts as a preliminary pharmacognostic parameter for identification and standardization of a particular drug from its adulterants. The Fluorescence behavior presence of the major bioactive compounds in the crude plant was found to be phenols, flavonoids, steroids and Coumarins (Table 4).

Table 4: Fluorescence analysis

S. No	Test	Colour observation		
		Visible Light	Short UV Light (254 nm)	Long UV Light (365 nm)
1	Plant powder	Grey	Pale green	Brown
2	Plant powder treated with distilled water	Black	Pale brown	Black
3	Plant powder treated with Hexane	Grey	Pale green	Black

4	Plant powder treated with Chloroform	Yellowish black	Brownish green	Brown
5	Plant powder treated with Methanol	Yellowish black	Greenish black	Brown
6	Plant powder treated with Acetone	Black	Greenish black	Black
7	Plant powder treated with 1N Sodium Hydroxide	Brownish black	Pale green	Black
8	Plant powder treated with 1N HCL	Brown	Greenish black	Black
9	Plant powder treated with sulphuric acid with equal volume of water	Brownish black	Yellowish green	Black
10	Plant powder treated with HNO_3 diluted with an equal volume of water	Pale brown	Yellowish green	Yellowish black

Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of Flavonoids, Tannin and Chlorophylls.

Table 5: Ultraviolet-visible spectroscopy analysis

Wavelength (nm)	*Compound identified (Harborne, 1973)
340	Flavonoids
390	Tannin
630	Chlorophyll

Detection of functional groups

Functional groups were detection by the method of Ahluwalia and Dhingra, (2004). A functional group is a group of atoms or bonds inside a substance that is responsible for the substance's unique chemical reactions. Qualitative functional groups analysis is used to determine the functional groups of in a molecule. This study was carried out to screen qualitative analysis of functional group present in the plant extract of plant. Table 6 represent the qualitative a functional groups analysis in plant.

Table 6: Analysis of functional groups

S. No	Functional groups	Results
1	Alcohols	+
2	Phenol	++
3	Aliphatic amines	++
4	Aldehydes	+
5	Ketones	++
6	Carboxylic acids	+

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Thin Layer Chromatography (Harborne, 1973).

Thin layer Chromatography is based upon the principles of column and partition Chromatography. A thin layer of the stationary phase is formed on a suitable flat surface, such as glass and plastic plate. Separation of a mixture in this case is achieved over a thin layer of alumina or silica gel to which they are absorbed by different physical forces. TLC plate prepared according to the standard procedure. (Harborne, 1973; Stahl, 1969). The presences of phytochemicsl in the extracts were detected by TLC using suitable spraying reagents. Detection of spots by using spraying reagents Colored substances can be seen directly when viewed

against the stationery phase whilst colorless species were detected by spraying the plate with appropriate reagent, which produced coloured areas in the regions, which they occupy (Harborne, 1973). The TLC report showed in the Plate 3 (Rf = 0.87).

Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Azadirachta indica* leaves contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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Asian Journal of Innovative Research. (2024): 8(4)

ISSN 2455 7285

Article Chemistry

PHYTOCHEMICAL EVALUATION OF *Trachyspermum ammi*

KESAVAN C

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

Received on July 2024 **Revised on Aug. 2024** **Online Nov. 2024**

INTRODUCTION

Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans further than those attributed to macronutrients and micronutrients (Hasler and Blumberg,1999). They protect plants from disease and damage and contribute to the plant‟s color, aroma and flavor. In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are called as phytochemicals (Mathai, 2000). Recently, it is clearly known that they have roles in the protection of human health, when their dietary intake is significant. More than 4,000 phytochemicals have been cataloged and are classified by protective function, physical characteristics and chemical characteristics (Meagher and Thomson, 1999). Plant-derived substances have recently become of great interest owing to their versatile applications. Medicinal plants are the richest bio-resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs.

The secondary metabolites formed also are an important trait for our food plants (taste, colour, scent, etc.) and ornamental plants. Moreover, numerous plant secondary metabolites such as flavonoids, alkaloids, tannins, saponins, steroids, anthocyanins, terpenoids, rotenoids etc. have found commercial application as drug, dye, flavour, fragrance, insecticide, etc. Such fine chemicals are extracted and purified from plant materials. Plant produces these chemicals to protect itself but recent research demonstrates that many phytochemicals can protect humans against diseases including cancer, cardiovascular, arthritis, diabetic, aging etc (Velavan, 2011). The techniques application of chromatography, mass spectrometry, infrared spectrometry, and nuclear magnetic resonance allowed quantitative and qualitative measurements of a large number of plant metabolites (Velavan, 2015).

Phytochemical screenings are preliminary tests conducted to detect the presence of both primary and secondary metabolites in an extract. Several qualitative analyses described below have been used to detect the presence of secondary metabolite like alkaloids, flavonoids, tannins, saponins, flavones, sterols, terpenes, cardiac glycosides while primary metabolites like protein, carbohydrates, and fats (Pandey and Tripathi, 2014; Beena *et al.*, 2016; Trease and Evans, 1989). This internship mainly deals with the general techniques involved in phytochemical analysis from plant source. The chosen plant

was *Trachyspermum ammi* (Tamil name: ஓமம்) seed.

TECHNIQUES AND OBSERVATION

Organoleptic character refers to evaluation each of the powdered traditional medicinal plant by colour, odour, taste, texture and shape (Koroma *et al.*, 2022). These criteria therefore should be considered aspects of raw material 'quality'. The responses for organoleptic characters are given in Table 1. The comparative study for organoleptic parameters such as color, taste, odour, texture and shape which confirm the overall acceptability

Table 1: Organoleptic Characters of herbal

Characters	Results
Colour	Brown
Odor	Characteristic smell
Taste	Light sweet
xture	Fine powder
pe	Uneven crystal

Phytochemicals extraction and identification

The seed powder of *Trachyspermum ammi* were purchased in June 2024 from Thanjavur district, Tamil Nadu, India. 1 gram of the powder transferred in to different conical flask (250ml). The conical flask containing 50ml of hydro-ethanol solvent. The conical flask containing sample were shaken well for 30 minutes by free hand. After 24 hrs, the extracts were filtered using Whatman filter paper No.1 and filtrate is used for further analysis. Chemical tests were carried out on the extract using standard procedures to identify the constituents as described by Harborne (1973 and 1976). Table 2 shows the presence of phytochemicals in hydro-ethanolic extract (Plate 1) and significant amounts of total phenol (112.38 mg/gm) and flavonoids (80 mg/gm) were repented.

Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	++
Saponin	++
Flavonoids	++
Steroids	++
Terpenoids	++
Alkaloids	+
Antroquinone	++
Polyphenol	++
Glycoside	++
Coumarins	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

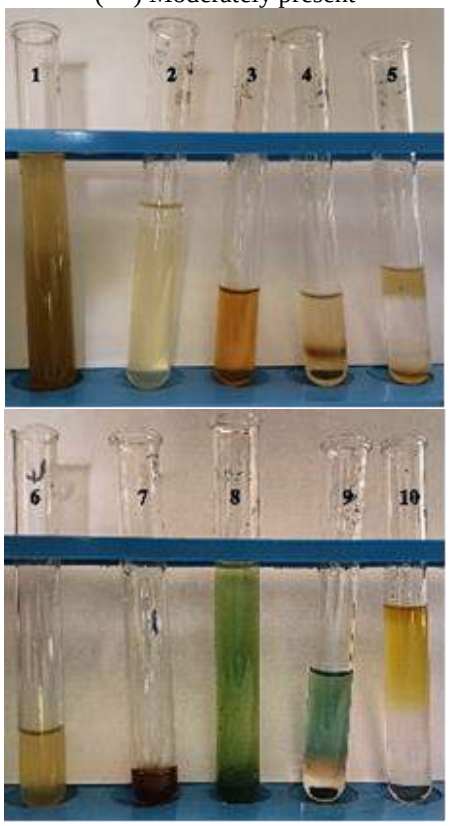

Plate 1: Qualitative screening of phytochemicals

Histochemical analysis

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Table 3: Histochemical analysis

S. No	Phytochemicals	Results
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4	Terpenoids	+
5	Polyphenol	++

(+) Indicates Presence; (++) Moderately present

Tannin

Flavonoids

Steroids

Polyphenol

Terpenoids

Plate 2: Histochemical analysis

Fluorescence analysis

Fluorescence analysis of entire of plant has been carried out in daylight and under UV light (Kokashi *et al.*, 1957). Fluorescence analysis of powder of plant was carried out by the treatment of different chemical reagents such as H_2O, H_2SO_4, HCl, NH_3, HNO_3, CH_3OH and NaOH. The fluorescence color shows specificity for each compound. It acts as a preliminary pharmacognostic parameter for identification and standardization of a particular drug from its adulterants. The Fluorescence behavior presence of the major bioactive compounds in the crude plant was found to be phenols, flavonoids, steroids and Coumarins (Table 4).

Table 4: Fluorescence analysis

S. No	Test	Colour observation		
		Visible Light	Short UV Light (254 nm)	Long UV Light (365 nm)
1	Plant powder	Green	Brown	Green
2	Plant powder treated with distilled water	Green	Brown	Light brown
3	Plant powder treated with Hexane	Light green	Brown	Green
4	Plant powder treated with Chloroform	Light green	Brown	Green
5	Plant powder treated with Methanol	Yellow	Brown	Dark green
6	Plant powder treated with Acetone	Dark brown	Black	Light brown
7	Plant powder treated with 1N Sodium Hydroxide	Light yellow	Brown	Dark brown
8	Plant powder treated with 1N HCL	Brown	Black	Dark brown
9	Plant powder treated with sulphuric acid with equal volume of water	Light brown	Black	Light green

10	Plant powder treated with HNO_3 diluted with an equal volume of water	Yellowish orange	Black	Green

Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of Flavonoids, Tannin and Chlorophylls.

Table 5: Ultraviolet-visible spectroscopy analysis

Wavelength (nm)	*Compound identified (Harborne, 1973)
340	Flavonoids
410	Tannin
640	Chlorophyll

Detection of functional groups

Functional groups were detection by the method of Ahluwalia and Dhingra, (2004). A functional group is a group of atoms or bonds inside a substance that is responsible for the substance's unique chemical reactions. Qualitative functional groups analysis is used to determine the functional groups of in a molecule. This study was carried out to screen qualitative analysis of functional group present in the plant extract of plant. Table 6 represent the qualitative a functional groups analysis in plant.

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Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Trachyspermum ammi* seed contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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Asian Journal of Innovative Research. (2024): 8(4)

ISSN 2455 7285

Article Chemistry

PHYTOCHEMICAL ASSESSMENT OF *Tinospora cordifolia*

DEEPAK R

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

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The secondary metabolites formed also are an important trait for our food plants (taste, colour, scent, etc.) and ornamental plants. Moreover, numerous plant secondary metabolites such as flavonoids, alkaloids, tannins, saponins, steroids, anthocyanins, terpenoids, rotenoids etc. have found commercial application as drug, dye, flavour, fragrance, insecticide, etc. Such fine chemicals are extracted and purified from plant materials. Plant produces these chemicals to protect itself but recent research demonstrates that many phytochemicals can protect humans against diseases including cancer, cardiovascular, arthritis, diabetic, aging etc (Velavan, 2011). The techniques application of chromatography, mass spectrometry, infrared spectrometry, and nuclear magnetic resonance allowed quantitative and qualitative measurements of a large number of plant metabolites (Velavan, 2015).

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was *Tinospora cordifolia* (Tamil name: சீந்தில் கொடி) leaves.

TECHNIQUES AND OBSERVATION

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Colour	Green
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Phytochemicals extraction and identification

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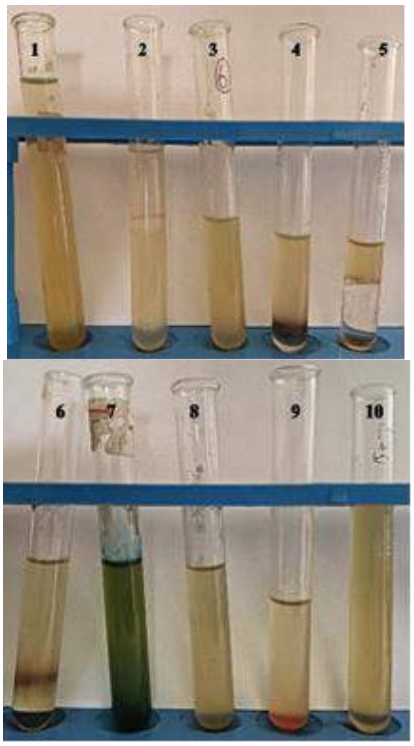
Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	++
Saponin	++
Flavonoids	++
Steroids	+
Terpenoids	++
Alkaloids	++
Antroquinone	++
Polyphenol	++
Glycoside	++
Coumarins	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present



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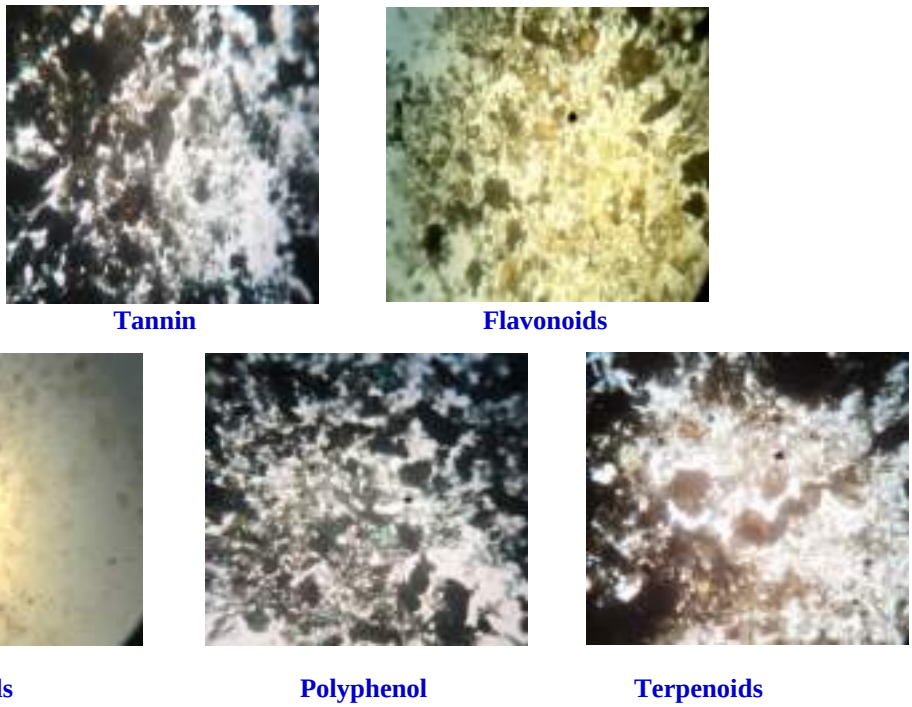

Plate 2: Histochemical analysis

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Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of Flavonoids, Tannin and Chlorophylls.

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Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Tinospora cordifolia* leaves contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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Asian Journal of Innovative Research. (2024): 8(4)

ISSN 2455 7285

Article Chemistry

PHYTOCHEMICAL SCREENING OF *Catharanthus roseus*

R. KAVIPRIYA

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

Received on July 2024 **Revised on Aug. 2024** **Online Nov. 2024**

INTRODUCTION

Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans further than those attributed to macronutrients and micronutrients (Hasler and Blumberg,1999). They protect plants from disease and damage and contribute to the plant‟s color, aroma and flavor. In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are called as phytochemicals (Mathai, 2000). Recently, it is clearly known that they have roles in the protection of human health, when their dietary intake is significant. More than 4,000 phytochemicals have been cataloged and are classified by protective function, physical characteristics and chemical characteristics (Meagher and Thomson, 1999). Plant-derived substances have recently become of great interest owing to their versatile applications. Medicinal plants are the richest bio-resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs.

The secondary metabolites formed also are an important trait for our food plants (taste, colour, scent, etc.) and ornamental plants. Moreover, numerous plant secondary metabolites such as flavonoids, alkaloids, tannins, saponins, steroids, anthocyanins, terpenoids, rotenoids etc. have found commercial application as drug, dye, flavour, fragrance, insecticide, etc. Such fine chemicals are extracted and purified from plant materials. Plant produces these chemicals to protect itself but recent research demonstrates that many phytochemicals can protect humans against diseases including cancer, cardiovascular, arthritis, diabetic, aging etc (Velavan, 2011). The techniques application of chromatography, mass spectrometry, infrared spectrometry, and nuclear magnetic resonance allowed quantitative and qualitative measurements of a large number of plant metabolites (Velavan, 2015).

Phytochemical screenings are preliminary tests conducted to detect the presence of both primary and secondary metabolites in an extract. Several qualitative analyses described below have been used to detect the presence of secondary metabolite like alkaloids, flavonoids, tannins, saponins, flavones, sterols, terpenes, cardiac glycosides while primary metabolites like protein, carbohydrates, and fats (Pandey and Tripathi, 2014; Beena *et al.*, 2016; Trease and Evans, 1989). This internship mainly deals with the general techniques involved in phytochemical analysis from plant source. The chosen plant

was *Catharanthus roseus* (Tamil name: நித்ய கல்யாணி) leaves.

TECHNIQUES AND OBSERVATION

Organoleptic character refers to evaluation each of the powdered traditional medicinal plant by colour, odour, taste, texture and shape (Koroma *et al.,* 2022). These criteria therefore should be considered aspects of raw material 'quality'. The responses for organoleptic characters are given in Table 1. The comparative study for organoleptic parameters such as color, taste, odour, texture and shape which confirm the overall acceptability

Table 1: Organoleptic Characters of herbal

Characters	Results
Colour	Dark greenish ash
Odor	Characteristic smell
Taste	Bitter
Texture	Fine powder
shape	Uneven crystal

Phytochemicals extraction and identification

The leaves powder of *Catharanthus roseus* were purchased in June 2024 from Thanjavur district, Tamil Nadu, India. 1 gram of the powder transferred in to different conical flask (250ml). The conical flask containing 50ml of hydro-ethanol solvent. The conical flask containing sample were shaken well for 30 minutes by free hand. After 24 hrs, the extracts were filtered using Whatman filter paper No.1 and filtrate is used for further analysis. Chemical tests were carried out on the extract using standard procedures to identify the constituents as described by Harborne (1973 and 1976). Table 2 shows the presence of phytochemicals in hydro-ethanolic extract (Plate 1) and significant amounts of total phenol (217.00 mg/gm) and flavonoids (70.00 mg/gm) were repented.

Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	+
Saponin	++
Flavonoids	++
Steroids	+
Terpenoids	++
Alkaloids	-
Antroquinone	+
Polyphenol	++
Glycoside	-
Coumarins	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Plate 1: Qualitative screening of phytochemicals

Histochemical analysis

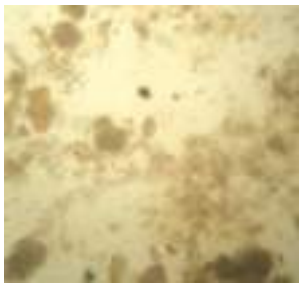
Histochemical analysis of plant powder were investigated. The different reagents treated with plant powder and observed under microscope. The histochemicals results revealed the presence of tannin, flavonoids, polyphenol, Steroids and terpenoids in plant. In this results further confirmed the presence of phytochemicals in plant (Table 3 and Plate 2).

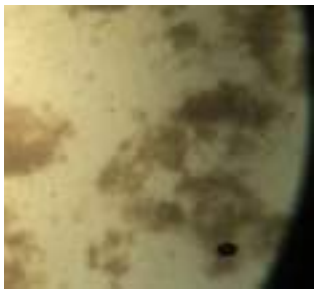
Table 3: Histochemical analysis

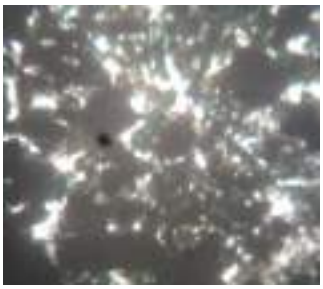
S. No	Phytochemicals	Results
1	Tannin	++
2	Flavonoids	++
3	Steroids	+
4	Terpenoids	+
5	Polyphenol	++

(+) Indicates Presence; (++) Moderately present


Tannin


Flavonoids


Steroids


Polyphenol


Terpenoids

Plate 2: Histochemical analysis

Fluorescence analysis

Fluorescence analysis of entire of plant has been carried out in daylight and under UV light (Kokashi *et al.*, 1957). Fluorescence analysis of powder of plant was carried out by the treatment of different chemical reagents such as H_2O, H_2SO_4, HCl, NH_3, HNO_3, CH_3OH and NaOH. The fluorescence color shows specificity for each compound. It acts as a preliminary pharmacognostic parameter for identification and standardization of a particular drug from its adulterants. The Fluorescence behavior presence of the major bioactive compounds in the crude plant was found to be phenols, flavonoids, steroids and Coumarins (Table 4).

Table 4: Fluorescence analysis

S. No	Test	Colour observation		
		Visible Light	Short UV Light (254 nm)	Long UV Light (365 nm)
1	Plant powder	Light green	Light green	Brown
2	Plant powder treated with distilled water	Brown	Dark green	Dark black
3	Plant powder treated with Hexane	Light green	Brownish green	Brown
4	Plant powder treated with Chloroform	Light green	Light green	Brown
5	Plant powder treated with Methanol	Light green	Light green	Brown
6	Plant powder treated with Acetone	Light green	Light yellow	Light brown
7	Plant powder treated with 1N Sodium Hydroxide	Yellowish brown	Green	Brown
8	Plant powder treated with 1N HCL	Light brown	Dark green	Black
9	Plant powder treated with sulphuric acid with equal volume of water	Brown	Brownish green	Dark black
10	Plant powder treated with HNO_3 diluted with an equal volume of water	Yellow	Green	Dark black

Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of Flavonoids, Carotenoids and Chlorophylls.

Table 5: Ultraviolet-visible spectroscopy analysis

Wavelength (nm)	*Compound identified (Harborne, 1973)
350	Flavonoids
400	Carotenoids
640	Chlorophyll

Detection of functional groups

Functional groups were detection by the method of Ahluwalia and Dhingra, (2004). A functional group is a group of atoms or bonds inside a substance that is responsible for the substance's unique chemical reactions. Qualitative functional groups analysis is used to determine the functional groups of in a molecule. This study was carried out to screen qualitative analysis of functional group present in the plant extract of plant. Table 6 represent the qualitative a functional groups analysis in plant.

Table 6: Analysis of functional groups

S. No	Functional groups	Results
1	Alcohols	+
2	Phenol	++
3	Aliphatic amines	++
4	Aldehydes	+
5	Ketones	+
6	Carboxylic acids	+

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Thin Layer Chromatography (Harborne, 1973).

Thin layer Chromatography is based upon the principles of column and partition Chromatography. A thin layer of the stationary phase is formed on a suitable flat surface, such as glass and plastic plate. Separation of a mixture in this case is achieved over a thin layer of alumina or silica gel to which they are absorbed by different physical forces. TLC plate prepared according to the standard procedure. (Harborne, 1973; Stahl, 1969). The presences of phytochemicsl in the extracts were detected by TLC using suitable spraying reagents. Detection of spots by using spraying reagents Colored substances can be seen directly when viewed against the stationery phase whilst colorless species were detected by spraying the plate with appropriate reagent, which produced coloured areas in the regions, which they occupy (Harborne, 1973). The TLC report showed in the Plate 3 (Rf = 0.78).

Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Catharanthus roseus* leaves contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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Asian Journal of Innovative Research. (2024): 8(4)

ISSN 2455 7285

Article Chemistry

PHYTOCHEMICAL ANALYSIS OF *Andrographis paniculata*

NARENDHIRAN G

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

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Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	++
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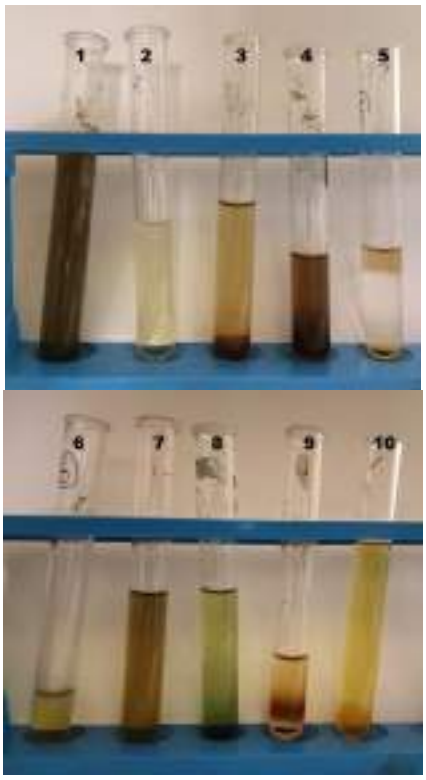
Flavonoids	++
Steroids	++
Terpenoids	++
Alkaloids	++
Antroquinone	++
Polyphenol	++
Glycoside	++
Coumarins	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present



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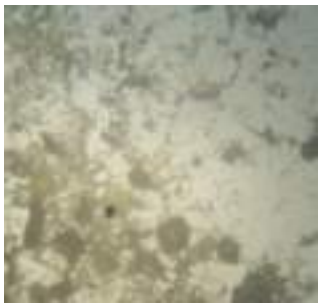
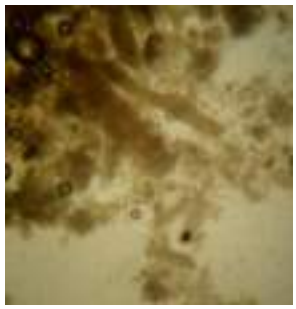

Tannin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Steroids


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Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Andrographis paniculata* leaves contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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Asian Journal of Innovative Research. (2024): 8(4)

ISSN 2455 7285

Article Chemistry

PHYTOCHEMICAL PROFILE OF *Moringa oleifera*

V. NARMADHA

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

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The secondary metabolites formed also are an important trait for our food plants (taste, colour, scent, etc.) and ornamental plants. Moreover, numerous plant secondary metabolites such as flavonoids, alkaloids, tannins, saponins, steroids, anthocyanins, terpenoids, rotenoids etc. have found commercial application as drug, dye, flavour, fragrance, insecticide, etc. Such fine chemicals are extracted and purified from plant materials. Plant produces these chemicals to protect itself but recent research demonstrates that many phytochemicals can protect humans against diseases including cancer, cardiovascular, arthritis, diabetic, aging etc (Velavan, 2011). The techniques application of chromatography, mass spectrometry, infrared spectrometry, and nuclear magnetic resonance allowed quantitative and qualitative measurements of a large number of plant metabolites (Velavan, 2015).

Phytochemical screenings are preliminary tests conducted to detect the presence of both primary and secondary metabolites in an extract. Several qualitative analyses described below have been used to detect the presence of secondary metabolite like alkaloids, flavonoids, tannins, saponins, flavones, sterols, terpenes, cardiac glycosides while primary metabolites like protein, carbohydrates, and fats (Pandey and Tripathi, 2014; Beena *et al.*, 2016; Trease and Evans, 1989). This internship mainly deals with the general techniques involved in phytochemical analysis from plant source. The chosen plant

was *Moringa oleifera* (Tamil name: முருங்கை கீரை) leaves.

TECHNIQUES AND OBSERVATION

Organoleptic character refers to evaluation each of the powdered traditional medicinal plant by colour, odour, taste, texture and shape (Koroma *et al.*, 2022). These criteria therefore should be considered aspects of raw material 'quality'. The responses for organoleptic characters are given in Table 1. The comparative study for organoleptic parameters such as color, taste, odour, texture and shape which confirm the overall acceptability

Table 1: Organoleptic Characters of herbal

Characters	Results
Colour	Dark greenish
Odor	Characteristic smell
Taste	Bitter
Texture	Fine powder
Shape	Uneven crystal

Phytochemicals extraction and identification

The leaves powder of *Moringa oleifera* were purchased in June 2024 from Thanjavur district, Tamil Nadu, India. 1 gram of the powder transferred in to different conical flask (250ml). The conical flask containing 50ml of hydro-ethanol solvent. The conical flask containing sample were shaken well for 30 minutes by free hand. After 24 hrs, the extracts were filtered using Whatman filter paper No.1 and filtrate is used for further analysis. Chemical tests were carried out on the extract using standard procedures to identify the constituents as described by Harborne (1973 and 1976). Table 2 shows the presence of phytochemicals in hydro-ethanolic extract (Plate 1) and significant amounts of total phenol (330 mg/gm) and flavonoids (200 mg/gm) were repented.

Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	+
Saponin	++
Flavonoids	++
Steroids	+
Terpenoids	+
Alkaloids	+
Antroquinone	-
Polyphenol	++
Glycoside	+
Coumarins	+

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Plate 1: Qualitative screening of phytochemicals

Histochemical analysis

Histochemical analysis of plant powder were investigated. The different reagents treated with plant powder and observed under microscope. The histochemicals results revealed the presence of tannin, flavonoids, polyphenol, Steroids and terpenoids in plant. In this results further confirmed the presence of phytochemicals in plant (Table 3 and Plate 2).

Table 3: Histochemical analysis

S. No	Phytochemicals	Results
1	Tannin	++
2	Flavonoids	++
3	Steroids	+
4	Terpenoids	+
5	Polyphenol	++

(+) Indicates Presence; (++) Moderately present


Tannin


Flavonoids


Steroids


Polyphenol

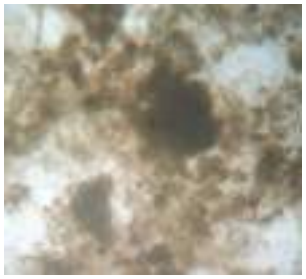
Terpenoids

Plate 2: Histochemical analysis

Fluorescence analysis

Fluorescence analysis of entire of plant has been carried out in daylight and under UV light (Kokashi *et al.*, 1957). Fluorescence analysis of powder of plant was carried out by the treatment of different chemical reagents such as H_2O, H_2SO_4, HCl, NH_3, HNO_3, CH_3OH and NaOH. The fluorescence color shows specificity for each compound. It acts as a preliminary pharmacognostic parameter for identification and standardization of a particular drug from its adulterants. The Fluorescence behavior presence of the major bioactive compounds in the crude plant was found to be phenols, flavonoids, steroids and Coumarins (Table 4).

Table 4: Fluorescence analysis

S. No	Test	Colour observation		
		Visible Light	Short UV Light (254 nm)	Long UV Light (365 nm)
1	Plant powder	Brown	Green	Black
2	Plant powder treated with distilled water	Green	Green	Green
3	Plant powder treated with Hexane	Brown	Brown	Black
4	Plant powder treated with Chloroform	Brown	Green	Black
5	Plant powder treated with Methanol	Green	Black	Green
6	Plant powder treated with Acetone	Brown	Brown	Black
7	Plant powder treated with 1N Sodium Hydroxide	Black	Black	Green
8	Plant powder treated with 1N HCL	Brown	Yellow	Black
9	Plant powder treated with sulphuric acid with equal volume of water	Black	Black	Black
10	Plant powder treated with HNO_3 diluted with an equal volume of water	Yellow	Brown	Black

Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are

recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of flavonols, Tannins and Chlorophylls.

Table 5: Ultraviolet-visible spectroscopy analysis

Wavelength (nm)	*Compound identified (Harborne, 1973)
340	Flavonoids
400	Tannins
640	Chlorophyll

Detection of functional groups

Functional groups were detection by the method of Ahluwalia and Dhingra, (2004). A functional group is a group of atoms or bonds inside a substance that is responsible for the substance's unique chemical reactions. Qualitative functional groups analysis is used to determine the functional groups of in a molecule. This study was carried out to screen qualitative analysis of functional group present in the plant extract of plant. Table 6 represent the qualitative a functional groups analysis in plant.

Table 6: Analysis of functional groups

S. No	Functional groups	Results
1	Alcohols	+
2	Phenol	+
3	Aliphatic amines	+
4	Aldehydes	+
5	Ketones	+
6	Carboxylic acids	+

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Thin Layer Chromatography (Harborne, 1973).

Thin layer Chromatography is based upon the principles of column and partition Chromatography. A thin layer of the stationary phase is formed on a suitable flat surface, such as glass and plastic plate. Separation of a mixture in this case is achieved over a thin layer of alumina or silica gel to which they are absorbed by different physical forces. TLC plate prepared according to the standard procedure. (Harborne, 1973; Stahl, 1969). The presences of phytochemicsl in the extracts were detected by TLC using suitable spraying reagents. Detection of spots by using spraying reagents Colored substances can be seen directly when viewed against the stationery phase whilst colorless species were detected by spraying the plate with appropriate reagent, which produced coloured areas in the regions, which they occupy (Harborne, 1973). The TLC report showed in the Plate 3 (Rf = 0.90).

Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Moringa oleifera* leaves contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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Asian Journal of Innovative Research. (2024): 8(4)

ISSN 2455 7285

Article Chemistry

PHYTOCHEMICAL CHARACTERIZATION OF *Adhatoda vasica*

NAVIN KUMAR K

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

Received on July 2024 **Revised on Aug. 2024** **Online Nov. 2024**

INTRODUCTION

Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans further than those attributed to macronutrients and micronutrients (Hasler and Blumberg,1999). They protect plants from disease and damage and contribute to the plant‟s color, aroma and flavor. In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are called as phytochemicals (Mathai, 2000). Recently, it is clearly known that they have roles in the protection of human health, when their dietary intake is significant. More than 4,000 phytochemicals have been cataloged and are classified by protective function, physical characteristics and chemical characteristics (Meagher and Thomson, 1999). Plant-derived substances have recently become of great interest owing to their versatile applications. Medicinal plants are the richest bio-resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs.

The secondary metabolites formed also are an important trait for our food plants (taste, colour, scent, etc.) and ornamental plants. Moreover, numerous plant secondary metabolites such as flavonoids, alkaloids, tannins, saponins, steroids, anthocyanins, terpenoids, rotenoids etc. have found commercial application as drug, dye, flavour, fragrance, insecticide, etc. Such fine chemicals are extracted and purified from plant materials. Plant produces these chemicals to protect itself but recent research demonstrates that many phytochemicals can protect humans against diseases including cancer, cardiovascular, arthritis, diabetic, aging etc (Velavan, 2011). The techniques application of chromatography, mass spectrometry, infrared spectrometry, and nuclear magnetic resonance allowed quantitative and qualitative measurements of a large number of plant metabolites (Velavan, 2015).

Phytochemical screenings are preliminary tests conducted to detect the presence of both primary and secondary metabolites in an extract. Several qualitative analyses described below have been used to detect the presence of secondary metabolite like alkaloids, flavonoids, tannins, saponins, flavones, sterols, terpenes, cardiac glycosides while primary metabolites like protein, carbohydrates, and fats (Pandey and Tripathi, 2014; Beena *et al.*, 2016; Trease and Evans, 1989). This internship mainly deals with the general techniques involved in phytochemical analysis from plant source. The chosen plant was *Adhatoda vasica* (Tamil name: ஆடாதோடை) leaves.

TECHNIQUES AND OBSERVATION

Organoleptic character refers to evaluation each of the powdered traditional medicinal plant by colour, odour, taste, texture and shape (Koroma *et al.*, 2022). These criteria therefore should be considered aspects of raw material 'quality'. The responses for organoleptic characters are given in Table 1. The comparative study for organoleptic parameters such as color, taste, odour, texture and shape which confirm the overall acceptability

Table 1: Organoleptic Characters of herbal

Characters	Results
Colour	Brownish green
Odor	Characteristic smell
Taste	Bitter
Texture	Fine powder
shape	Uneven crystal

Phytochemicals extraction and identification

The leaves powder of *Adhatoda vasica* were purchased in June 2024 from Thanjavur district, Tamil Nadu, India. 1 gram of the powder transferred in to different conical flask (250ml). The conical flask containing 50ml of hydro-ethanol solvent. The conical flask containing sample were shaken well for 30 minutes by free hand. After 24 hrs, the extracts were filtered using Whatman filter paper No.1 and filtrate is used for further analysis. Chemical tests were carried out on the extract using standard procedures to identify the constituents as described by Harborne (1973 and 1976). Table 2 shows the presence of phytochemicals in hydro-ethanolic extract (Plate 1) and significant amounts of total phenol (224.85 mg/gm) and flavonoids (100 mg/gm) were repented.

Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	++
Saponin	++
Flavonoids	++
Steroids	+
Terpenoids	++
Alkaloids	+
Antroquinone	++
Polyphenol	++
Glycoside	++
Coumarins	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

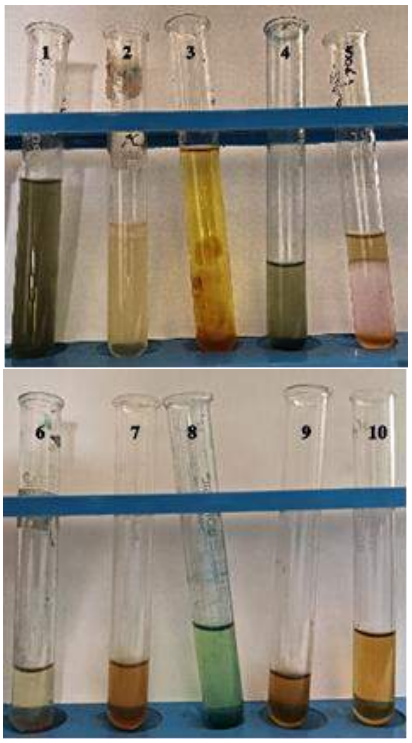


Plate 1: Qualitative screening of phytochemicals

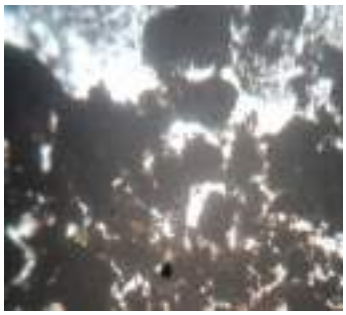
Histochemical analysis

Histochemical analysis of plant powder were investigated. The different reagents treated with plant powder and observed under microscope. The histochemicals results revealed the presence of tannin, flavonoids, polyphenol, Steroids and terpenoids in plant. In this results further confirmed the presence of phytochemicals in plant (Table 3 and Plate 2).

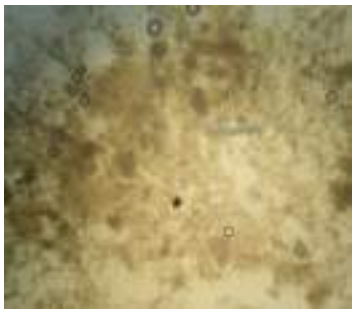
Table 3: Histochemical analysis

S. No	Phytochemicals	Results
1	Tannin	++
2	Flavonoids	++
3	Steroids	++
4	Terpenoids	++
5	Polyphenol	++

(+) Indicates Presence; (++) Moderately present



Tannin



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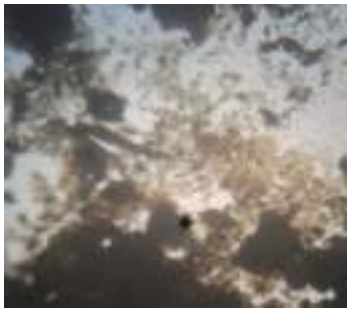
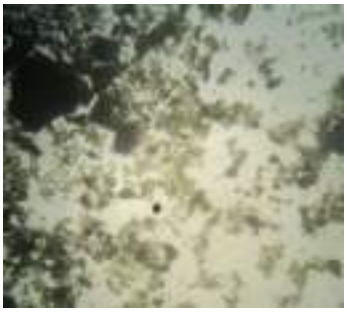
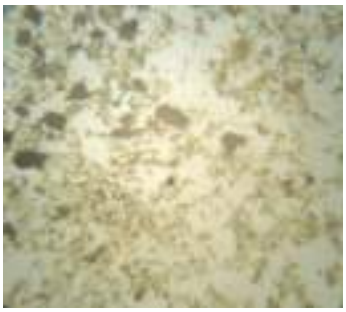


Steroids



Polyphenol



Terpenoids

Plate 2: Histochemical analysis

Fluorescence analysis

Fluorescence analysis of entire of plant has been carried out in daylight and under UV light (Kokashi *et al.*, 1957). Fluorescence analysis of powder of plant was carried out by the treatment of different chemical reagents such as H_2O, H_2SO_4, HCl, NH_3, HNO_3, CH_3OH and NaOH. The fluorescence color shows specificity for each compound. It acts as a preliminary pharmacognostic parameter for identification and standardization of a particular drug from its adulterants. The Fluorescence behavior presence of the major bioactive compounds in the crude plant was found to be phenols, flavonoids, steroids and Coumarins (Table 4).

Table 4: Fluorescence analysis

S. No	Test	Colour observation		
		Visible Light	Short UV Light (254 nm)	Long UV Light (365 nm)
1	Plant powder	Pale brown	Whitish brown	Black
2	Plant powder treated with distilled water	Greenish brown	Blackish green	Black
3	Plant powder treated with Hexane	Whitish brown	Dark green	Black
4	Plant powder treated with Chloroform	Greenish brown	Green	Black
5	Plant powder treated with Methanol	Whitish black	Black	Black
6	Plant powder treated with Acetone	Whitish brown	Black	Black
7	Plant powder treated with 1N Sodium Hydroxide	Whitish brown	Pale green	Black
8	Plant powder treated with 1N HCL	Pale green	Blackish green	Black
9	Plant powder treated with sulphuric acid with equal volume of water	Dark brown	Green	Black

10	Plant powder treated with HNO_3 diluted with an equal volume of water	Reddish brown	Green	Black

Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of Flavonoids, Tannin and Chlorophylls.

Table 5: Ultraviolet-visible spectroscopy analysis

Wavelength (nm)	*Compound identified (Harborne, 1973)
340	Flavonoids
400	Tannin
620	Chlorophyll

Detection of functional groups

Functional groups were detection by the method of Ahluwalia and Dhingra, (2004). A functional group is a group of atoms or bonds inside a substance that is responsible for the substance's unique chemical reactions. Qualitative functional groups analysis is used to determine the functional groups of in a molecule. This study was carried out to screen qualitative analysis of functional group present in the plant extract of plant. Table 6 represent the qualitative a functional groups analysis in plant.

Table 6: Analysis of functional groups

S. No	Functional groups	Results
1	Alcohols	+
2	Phenol	++
3	Aliphatic amines	+
4	Aldehydes	+
5	Ketones	+
6	Carboxylic acids	++

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Thin Layer Chromatography (Harborne, 1973).

Thin layer Chromatography is based upon the principles of column and partition Chromatography. A thin layer of the stationary phase is formed on a suitable flat surface, such as glass and plastic plate. Separation of a mixture in this case is achieved over a thin layer of alumina or silica gel to which they are absorbed by different physical forces. TLC plate prepared according to the standard procedure. (Harborne, 1973; Stahl, 1969). The presences of phytochemicsl in the extracts were detected by TLC using suitable spraying reagents. Detection of spots by using spraying reagents Colored substances can be seen directly when viewed against the stationery phase whilst colorless species were detected by spraying the plate with appropriate reagent, which produced coloured areas in the regions, which they occupy (Harborne, 1973). The TLC report showed in the Plate 3 (Rf = 0.72).

Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Adhatoda vasica* leaves contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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Asian Journal of Innovative Research. (2024): 8(4)

ISSN 2455 7285

Article Chemistry

QUALITATIVE SCREENING OF PHYTOCHEMICAL USING *Mimosa pudica*

M. NITHIYA SRI

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

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TECHNIQUES AND OBSERVATION

Organoleptic character refers to evaluation each of the powdered traditional medicinal plant by colour, odour, taste, texture and shape (Koroma *et al.*, 2022). These criteria therefore should be considered aspects of raw material 'quality'. The responses for organoleptic characters are given in Table 1. The comparative study for organoleptic parameters such as color, taste, odour, texture and shape which confirm the overall acceptability

Table 1: Organoleptic Characters of herbal

Characters	Results
Colour	Greenish
Odor	Characteristic smell
Taste	Bitter
Texture	Fine powder
Shape	Uneven crystal

Phytochemicals extraction and identification

The leaves powder of *Mimosa pudica* were purchased in June 2024 from Thanjavur district, Tamil Nadu, India. 1 gram of the powder transferred in to different conical flask (250ml). The conical flask containing 50ml of hydro-ethanol solvent. The conical flask containing sample were shaken well for 30 minutes by free hand. After 24 hrs, the extracts were filtered using Whatman filter paper No.1 and filtrate is used for further analysis. Chemical tests were carried out on the extract using standard procedures to identify the constituents as described by Harborne (1973 and 1976). Table 2 shows the presence of phytochemicals in hydro-ethanolic extract (Plate 1) and significant amounts of total phenol (214.00 mg/gm) and flavonoids (100.00 mg/gm) were repented.

Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	+
Saponin	++
Flavonoids	++
Steroids	+
Terpenoids	+
Alkaloids	+
Antroquinone	-
Polyphenol	++
Glycoside	+
Coumarins	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

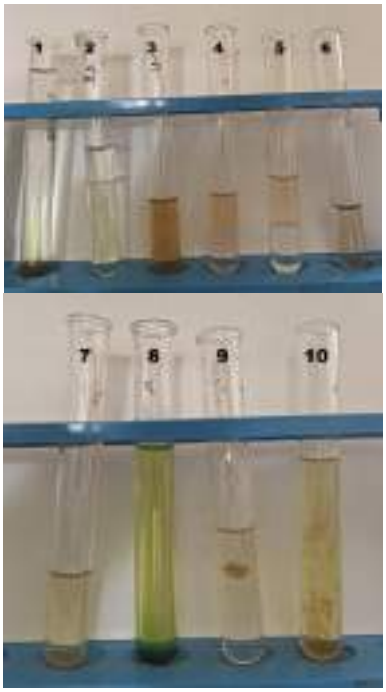


Plate 1: Qualitative screening of phytochemicals

Histochemical analysis

Histochemical analysis of plant powder were investigated. The different reagents treated with plant powder and observed under microscope. The histochemicals results revealed the presence of tannin, flavonoids, polyphenol, Steroids and terpenoids in plant. In this results further confirmed the presence of phytochemicals in plant (Table 3 and Plate 2).

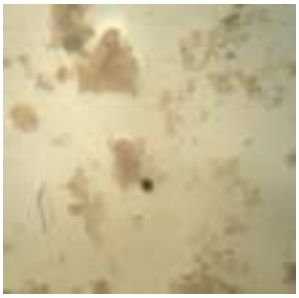
Table 3: Histochemical analysis

S. No	Phytochemicals	Results
1	Tannin	+
2	Flavonoids	++
3	Steroids	+
4	Terpenoids	+
5	Polyphenol	++

(+) Indicates Presence; (++) Moderately present


Tannin


Flavonoids


Steroids


Polyphenol


Terpenoids

Plate 2: Histochemical analysis

Fluorescence analysis

Fluorescence analysis of entire of plant has been carried out in daylight and under UV light (Kokashi *et al.,* 1957). Fluorescence analysis of powder of plant was carried out by the treatment of different chemical reagents such as H_2O, H_2SO_4, HCl, NH_3, HNO_3, CH_3OH and NaOH. The fluorescence color shows specificity for each compound. It acts as a preliminary pharmacognostic parameter for identification and standardization of a particular drug from its adulterants. The Fluorescence behavior presence of the major bioactive compounds in the crude plant was found to be phenols, flavonoids, steroids and Coumarins (Table 4).

Table 4: Fluorescence analysis

S. No	Test	Colour observation		
		Visible Light	Short UV Light (254 nm)	Long UV Light (365 nm)
1	Plant powder	Green	Green	Black
2	Plant powder treated with distilled water	Brown	Green	Green
3	Plant powder treated with Hexane	Brown	Brown	Black
4	Plant powder treated with Chloroform	Green	Green	Brown
5	Plant powder treated with Methanol	Black	Black	Black
6	Plant powder treated with Acetone	Green	Green	Green
7	Plant powder treated with 1N Sodium Hydroxide	Yellow	Green	Black
8	Plant powder treated with 1N HCL	Brown	Green	Green
9	Plant powder treated with sulphuric acid with equal volume of water	Black	Brown	Brown

10	Plant powder treated with HNO_3 diluted with an equal volume of water	Yellow	Yellow	Green

Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of flavonols, Carotenoids and Chlorophylls.

Table 5: Ultraviolet-visible spectroscopy analysis

Wavelength (nm)	*Compound identified (Harborne, 1973)
340-350	Flavonoids
410	Carotenoids
640	Chlorophyll

Detection of functional groups

Functional groups were detection by the method of Ahluwalia and Dhingra, (2004). A functional group is a group of atoms or bonds inside a substance that is responsible for the substance's unique chemical reactions. Qualitative functional groups analysis is used to determine the functional groups of in a molecule. This study was carried out to screen qualitative analysis of functional group present in the plant extract of plant. Table 6 represent the qualitative a functional groups analysis in plant.

Table 6: Analysis of functional groups

S. No	Functional groups	Results
1	Alcohols	+
2	Phenol	++
3	Aliphatic amines	++
4	Aldehydes	+
5	Ketones	+
6	Carboxylic acids	+

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Thin Layer Chromatography (Harborne, 1973).

Thin layer Chromatography is based upon the principles of column and partition Chromatography. A thin layer of the stationary phase is formed on a suitable flat surface, such as glass and plastic plate. Separation of a mixture in this case is achieved over a thin layer of alumina or silica gel to which they are absorbed by different physical forces. TLC plate prepared according to the standard procedure. (Harborne, 1973; Stahl, 1969). The presences of phytochemicsl in the extracts were detected by TLC using suitable spraying reagents. Detection of spots by using spraying reagents Colored substances can be seen directly when viewed against the stationery phase whilst colorless species were detected by spraying the plate with appropriate reagent, which produced coloured areas in the regions, which they occupy (Harborne, 1973). The TLC report showed in the Plate 3 (Rf = 0.81).

Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Mimosa pudica* leaves contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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Asian Journal of Innovative Research. (2024): 8(4)

ISSN 2455 7285

Article Chemistry

PHYTOCHEMICAL CHARACTERIZATION OF *Ocimum tenuiflorum*

K. RAJESHWARI

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

Received on July 2024 **Revised on Aug. 2024** **Online Nov. 2024**

INTRODUCTION

Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans further than those attributed to macronutrients and micronutrients (Hasler and Blumberg,1999). They protect plants from disease and damage and contribute to the plant‟s color, aroma and flavor. In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are called as phytochemicals (Mathai, 2000). Recently, it is clearly known that they have roles in the protection of human health, when their dietary intake is significant. More than 4,000 phytochemicals have been cataloged and are classified by protective function, physical characteristics and chemical characteristics (Meagher and Thomson, 1999). Plant-derived substances have recently become of great interest owing to their versatile applications. Medicinal plants are the richest bio-resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs.

The secondary metabolites formed also are an important trait for our food plants (taste, colour, scent, etc.) and ornamental plants. Moreover, numerous plant secondary metabolites such as flavonoids, alkaloids, tannins, saponins, steroids, anthocyanins, terpenoids, rotenoids etc. have found commercial application as drug, dye, flavour, fragrance, insecticide, etc. Such fine chemicals are extracted and purified from plant materials. Plant produces these chemicals to protect itself but recent research demonstrates that many phytochemicals can protect humans against diseases including cancer, cardiovascular, arthritis, diabetic, aging etc (Velavan, 2011). The techniques application of chromatography, mass spectrometry, infrared spectrometry, and nuclear magnetic resonance allowed quantitative and qualitative measurements of a large number of plant metabolites (Velavan, 2015).

Phytochemical screenings are preliminary tests conducted to detect the presence of both primary and secondary metabolites in an extract. Several qualitative analyses described below have been used to detect the presence of secondary metabolite like alkaloids, flavonoids, tannins, saponins, flavones, sterols, terpenes, cardiac glycosides while primary metabolites like protein, carbohydrates, and fats (Pandey and Tripathi, 2014; Beena *et al.*, 2016; Trease and Evans, 1989). This internship mainly deals with the general techniques involved in phytochemical analysis from plant source. The chosen plant

was *Ocimum tenuiflorum* (Tamil name: துளசி) leaves.

TECHNIQUES AND OBSERVATION

Organoleptic character refers to evaluation each of the powdered traditional medicinal plant by colour, odour, taste, texture and shape (Koroma *et al.*, 2022). These criteria therefore should be considered aspects of raw material 'quality'. The responses for organoleptic characters are given in Table 1. The comparative study for organoleptic parameters such as color, taste, odour, texture and shape which confirm the overall acceptability

Table 1: Organoleptic Characters of herbal

Characters	Results
Colour	Greenish Ash
Odor	Characteristic smell
Taste	Bitter
Texture	Fine powder
Shape	Uneven crystal

Phytochemicals extraction and identification

The leaves powder of *Ocimum tenuiflorum* were purchased in June 2024 from Thanjavur district, Tamil Nadu, India. 1 gram of the powder transferred in to different conical flask (250ml). The conical flask containing 50ml of hydro-ethanol solvent. The conical flask containing sample were shaken well for 30 minutes by free hand. After 24 hrs, the extracts were filtered using Whatman filter paper No.1 and filtrate is used for further analysis. Chemical tests were carried out on the extract using standard procedures to identify the constituents as described by Harborne (1973 and 1976). Table 2 shows the presence of phytochemicals in hydro-ethanolic extract (Plate 1) and significant amounts of total phenol (214.00 mg/gm) and flavonoids (50.00 mg/gm) were repented.

Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	+
Saponin	+
Flavonoids	++
Steroids	+
Terpenoids	+
Alkaloids	-
Antroquinone	+
Polyphenol	++
Glycoside	+
Coumarins	+

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Plate 1: Qualitative screening of phytochemicals

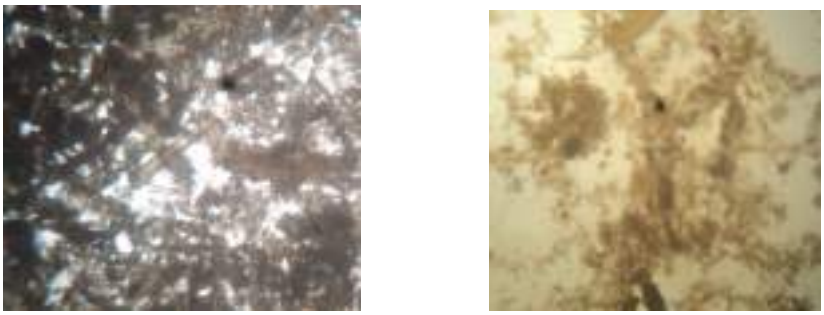
Histochemical analysis

Histochemical analysis of plant powder were investigated. The different reagents treated with plant powder and observed under microscope. The histochemicals results revealed the presence of tannin, flavonoids, polyphenol, Steroids and terpenoids in plant. In this results further confirmed the presence of phytochemicals in plant (Table 3 and Plate 2).

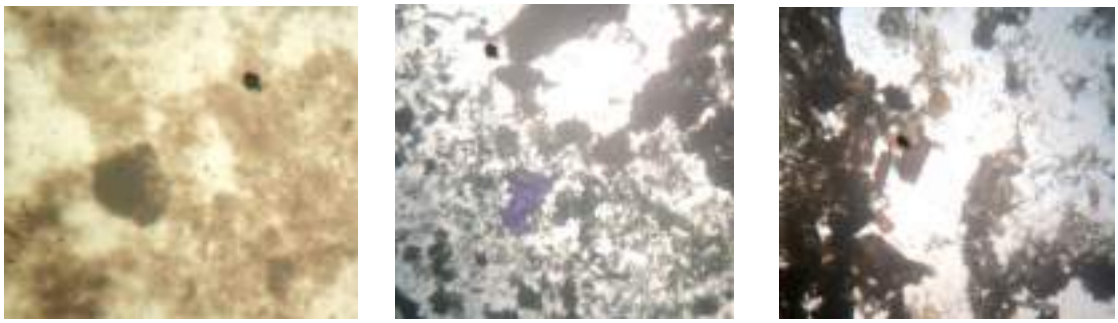
Table 3: Histochemical analysis

S. No	Phytochemicals	Results
1	Tannin	+
2	Flavonoids	++
3	Steroids	+
4	Terpenoids	+
5	Polyphenol	++

(+) Indicates Presence; (++) Moderately present



Tannin Flavonoids



Steroids Polyphenol Terpenoids

Plate 2: Histochemical analysis

Fluorescence analysis

Fluorescence analysis of entire of plant has been carried out in daylight and under UV light (Kokashi *et al.*, 1957). Fluorescence analysis of powder of plant was carried out by the treatment of different chemical reagents such as H_2O, H_2SO_4, HCl, NH_3, HNO_3, CH_3OH and NaOH. The fluorescence color shows specificity for each compound. It acts as a preliminary pharmacognostic parameter for identification and standardization of a particular drug from its adulterants. The Fluorescence behavior presence of the major bioactive compounds in the crude plant was found to be phenols, flavonoids, steroids and Coumarins (Table 4).

Table 4: Fluorescence analysis

S. No	Test	Colour observation		
		Visible Light	Short UV Light (254 nm)	Long UV Light (365 nm)
1	Plant powder	Light brown	Light green	Brown
2	Plant powder treated with distilled water	Light green	Brownish green	Black
3	Plant powder treated with Hexane	Brownish green	Light green	Light black
4	Plant powder treated with Chloroform	Light green	Green	Dark black
5	Plant powder treated with Methanol	Brown	Brown	Black
6	Plant powder treated with Acetone	Brownish green	Light green	Black
7	Plant powder treated with 1N Sodium Hydroxide	Dark brown	Yellowish brown	Dark black
8	Plant powder treated with 1N HCL	Light green	Light green	Brown
9	Plant powder treated with sulphuric acid with equal volume of water	Dark green	Dark green	Light brown
10	Plant powder treated with HNO_3 diluted with	Brownish	Brown	Dark black

	an equal volume of water	orange		

Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of flavonols, Carotenoids and Chlorophylls.

Table 5: Ultraviolet-visible spectroscopy analysis

Wavelength (nm)	*Compound identified (Harborne, 1973)
340	Flavonoids
400	Carotenoids
800	Chlorophylls

Detection of functional groups

Functional groups were detection by the method of Ahluwalia and Dhingra, (2004). A functional group is a group of atoms or bonds inside a substance that is responsible for the substance's unique chemical reactions. Qualitative functional groups analysis is used to determine the functional groups of in a molecule. This study was carried out to screen qualitative analysis of functional group present in the plant extract of plant. Table 6 represent the qualitative a functional groups analysis in plant.

Table 6: Analysis of functional groups

S. No	Functional groups	Results
1	Alcohols	+
2	Phenol	+
3	Aliphatic amines	+
4	Aldehydes	+
5	Ketones	-
6	Carboxylic acids	+

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Thin Layer Chromatography (Harborne, 1973).

Thin layer Chromatography is based upon the principles of column and partition Chromatography. A thin layer of the stationary phase is formed on a suitable flat surface, such as glass and plastic plate. Separation of a mixture in this case is achieved over a thin layer of alumina or silica gel to which they are absorbed by different physical forces. TLC plate prepared according to the standard procedure. (Harborne, 1973; Stahl, 1969). The presences of phytochemicsl in the extracts were detected by TLC using suitable spraying reagents. Detection of spots by using spraying reagents Colored substances can be seen directly when viewed against the stationery phase whilst colorless species were detected by spraying the plate with appropriate reagent, which produced coloured areas in the regions, which they occupy (Harborne, 1973). The TLC report showed in the Plate 3 (Rf =0.86).

Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Ocimum tenuiflorum* leaves contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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Asian Journal of Innovative Research. (2024): 8(4)

ISSN 2455 7285

Article Chemistry

IDENTIFICATION OF PHYTOCHEMICAL FROM *Phyllanthus emblica*

A. RASIKA

Department of Chemistry, H.H. The Rajah's College (Autonomous), An Autonomous College Affiliated to Bharathidasan University Accredited by NAAC with 'B' Grade, Madurai Road, Pudukkottai - 622 001 Tamil Nadu.

Received on July 2024 **Revised on Aug. 2024** **Online Nov. 2024**

INTRODUCTION

Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans further than those attributed to macronutrients and micronutrients (Hasler and Blumberg,1999). They protect plants from disease and damage and contribute to the plant‟s color, aroma and flavor. In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are called as phytochemicals (Mathai, 2000). Recently, it is clearly known that they have roles in the protection of human health, when their dietary intake is significant. More than 4,000 phytochemicals have been cataloged and are classified by protective function, physical characteristics and chemical characteristics (Meagher and Thomson, 1999). Plant-derived substances have recently become of great interest owing to their versatile applications. Medicinal plants are the richest bio-resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs.

The secondary metabolites formed also are an important trait for our food plants (taste, colour, scent, etc.) and ornamental plants. Moreover, numerous plant secondary metabolites such as flavonoids, alkaloids, tannins, saponins, steroids, anthocyanins, terpenoids, rotenoids etc. have found commercial application as drug, dye, flavour, fragrance, insecticide, etc. Such fine chemicals are extracted and purified from plant materials. Plant produces these chemicals to protect itself but recent research demonstrates that many phytochemicals can protect humans against diseases including cancer, cardiovascular, arthritis, diabetic, aging etc (Velavan, 2011). The techniques application of chromatography, mass spectrometry, infrared spectrometry, and nuclear magnetic resonance allowed quantitative and qualitative measurements of a large number of plant metabolites (Velavan, 2015).

Phytochemical screenings are preliminary tests conducted to detect the presence of both primary and secondary metabolites in an extract. Several qualitative analyses described below have been used to detect the presence of secondary metabolite like alkaloids, flavonoids, tannins, saponins, flavones, sterols, terpenes, cardiac glycosides while primary metabolites like protein, carbohydrates, and fats (Pandey and Tripathi, 2014; Beena *et al.*, 2016; Trease and Evans, 1989). This internship mainly deals with the general techniques involved in phytochemical analysis from plant source. The chosen plant was *Phyllanthus emblica* (Tamil name: நெல்லி) leaves.

TECHNIQUES AND OBSERVATION

Organoleptic character refers to evaluation each of the powdered traditional medicinal plant by colour, odour, taste, texture and shape (Koroma *et al.*, 2022). These criteria therefore should be considered aspects of raw material 'quality'. The responses for organoleptic characters are given in Table 1. The comparative study for organoleptic parameters such as color, taste, odour, texture and shape which confirm the overall acceptability

Table 1: Organoleptic Characters of herbal

Characters	Results
Colour	Dark greenish
Odor	Characteristic smell
Taste	Bitter
Texture	Fine powder
Shape	Uneven crystal

Phytochemicals extraction and identification

The leaves powder of *Phyllanthus emblica* were purchased in June 2024 from Thanjavur district, Tamil Nadu, India. 1 gram of the powder transferred in to different conical flask (250ml). The conical flask containing 50ml of hydro-ethanol solvent. The conical flask containing sample were shaken well for 30 minutes by free hand. After 24 hrs, the extracts were filtered using Whatman filter paper No.1 and filtrate is used for further analysis. Chemical tests were carried out on the extract using standard procedures to identify the constituents as described by Harborne (1973 and 1976). Table 2 shows the presence of phytochemicals in hydro-ethanolic extract (Plate 1) and significant amounts of total phenol (219.00 mg/gm) and flavonoids (50.00 mg/gm) were repented.

Table 2: Qualitative screening of phytochemicals

Test name	Hydro-ethanolic extract
Tannin	++
Saponin	+
Flavonoids	++
Steroids	+
Terpenoids	++
Alkaloids	+
Antroquinone	+
Polyphenol	+
Glycoside	-
Coumarins	++

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

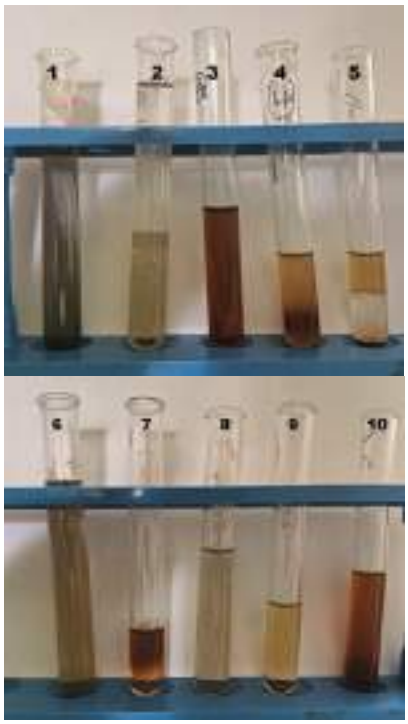


Plate 1: Qualitative screening of phytochemicals

Histochemical analysis

Histochemical analysis of plant powder were investigated. The different reagents treated with plant powder and observed under microscope. The histochemicals results revealed the presence of tannin, flavonoids, polyphenol, Steroids and terpenoids in plant. In this results further confirmed the presence of phytochemicals in plant (Table 3 and Plate 2).

Table 3: Histochemical analysis

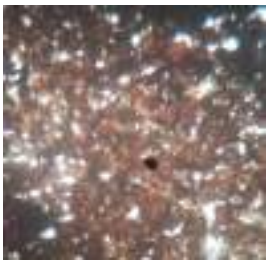
S. No	Phytochemicals	Results
1	Tannin	+
2	Flavonoids	++
3	Steroids	+
4	Terpenoids	++
5	Polyphenol	++

(+) Indicates Presence; (++) Moderately present


Tannin


Flavonoids


Steroids


Polyphenol


Terpenoids

Plate 2: Histochemical analysis

Fluorescence analysis

Fluorescence analysis of entire of plant has been carried out in daylight and under UV light (Kokashi *et al.*, 1957). Fluorescence analysis of powder of plant was carried out by the treatment of different chemical reagents such as H_2O, H_2SO_4, HCl, NH_3, HNO_3, CH_3OH and NaOH. The fluorescence color shows specificity for each compound. It acts as a preliminary pharmacognostic parameter for identification and standardization of a particular drug from its adulterants. The Fluorescence behavior presence of the major bioactive compounds in the crude plant was found to be phenols, flavonoids, steroids and Coumarins (Table 4).

Table 4: Fluorescence analysis

S. No	Test	Colour observation		
		Visible Light	Short UV Light (254 nm)	Long UV Light (365 nm)
1	Plant powder	Greenish	Brownish	Black
2	Plant powder treated with distilled water	Black	Greenish	Black
3	Plant powder treated with Hexane	Brownish	Brownish	Black
4	Plant powder treated with Chloroform	Brownish	Greenish	Black
5	Plant powder treated with Methanol	Black	Black	Brownish
6	Plant powder treated with Acetone	Brownish	Greenish	Brownish
7	Plant powder treated with 1N Sodium Hydroxide	Yellow	Greenish	Black
8	Plant powder treated with 1N HCL	Greenish	Greenish	Black
9	Plant powder treated with sulphuric acid with equal volume of water	Black	Black	Greenish
10	Plant powder treated with HNO_3 diluted with an equal volume of water	Yellow	Greenish	Black

Ultraviolet-visible spectroscopy analysis

The absorption spectra of plant constituents can be measured in very dilute solution against a solvent blank using an automatic recording spectrophotometer. For colourless compounds, measurements are made in the range 340 to 400 nanometres (nm); for coloured compounds, the range is 400 to 700 nm. The wavelengths of the maxima and minima of the absorption spectrum so obtained are

recorded (in nm) and also the intensity of the absorbance (or optical density) at the particular maxima and minima (Table 5) spectral measurements are important in the identification of many plant constituents, crude plant extracts for the presence of flavonols, Tannins and Chlorophylls.

Table 5: Ultraviolet-visible spectroscopy analysis

Wavelength (nm)	*Compound identified (Harborne, 1973)
340	Flavonoids
410	Tannin
640	Chlorophyll

Detection of functional groups

Functional groups were detection by the method of Ahluwalia and Dhingra, (2004). A functional group is a group of atoms or bonds inside a substance that is responsible for the substance's unique chemical reactions. Qualitative functional groups analysis is used to determine the functional groups of in a molecule. This study was carried out to screen qualitative analysis of functional group present in the plant extract of plant. Table 6 represent the qualitative a functional groups analysis in plant.

Table 6: Analysis of functional groups

S. No	Functional groups	Results
1	Alcohols	+
2	Phenol	+
3	Aliphatic amines	+
4	Aldehydes	+
5	Ketones	+
6	Carboxylic acids	+

(-) Indicates Absence; (+) Indicates Presence; (++) Moderately present

Thin Layer Chromatography (Harborne, 1973).

Thin layer Chromatography is based upon the principles of column and partition Chromatography. A thin layer of the stationary phase is formed on a suitable flat surface, such as glass and plastic plate. Separation of a mixture in this case is achieved over a thin layer of alumina or silica gel to which they are absorbed by different physical forces. TLC plate prepared according to the standard procedure. (Harborne, 1973; Stahl, 1969). The presences of phytochemicsl in the extracts were detected by TLC using suitable spraying reagents. Detection of spots by using spraying reagents Colored substances can be seen directly when viewed against the stationery phase whilst colorless species were detected by spraying the plate with appropriate reagent, which produced coloured areas in the regions, which they occupy (Harborne, 1973). The TLC report showed in the Plate 3 (Rf = 0.90).

Plate 3: Thin Layer Chromatography

SUMMARY

Overall, I found that *Phyllanthus emblica* leaves contain rich sources of phytochemicals identified by various phytochemical techniques. A rich source of various phytochemicals widely used in phyto-pharmacological research for health-promoting activity.

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