Phytochemical information of ethnomedicinally important plant (Mesua ferrea) seed shell

Chandravathi Dibba
Department of Botany, Andhra University College of Science and Technology, Visakhapatnam-530 003, Andhra Pradesh, India

Salugu Bodayya Padal
Department of Botany, Andhra University College of Science and Technology, Visakhapatnam-530 003, Andhra Pradesh, India

Sunitha Katta
GITAM School of Pharmacy, Visakhapatnam-530045, Andhra Pradesh, India

Prakasa Rao Jonnakuti
Department of Botany, Andhra University College of Science and Technology, Visakhapatnam-530 003, Andhra Pradesh, India

Abstract

The objective of the present work is to identify the phytochemical constituents of a plant material of ethnomedicinal importance, namely the seed shell of Mesua ferrea. The seed shell of Mesua ferrea was extracted with different solvents, namely hexane, chloroform and methanol, in Soxhlet apparatus. Subsequently, the phytochemical constituents, including carbohydrates, tannins, phytosterols, terpenoids, flavonoids, saponins, anthraquinone glycosides, and alkaloids, were identified using established procedures for all three extracts.

Numerous phytochemical constituents were detected in the plant materials in almost all extracts. The presence of significant constituents, namely alkaloids, was found in the hexane and chloroform extracts, while the phytosterols and anthraquinone glycosides were also present. The terpenoids, flavonoids, and carbohydrates were also found in the hexane and methanol extracts, and the tannins were detected in the methanol extract. Finally, the component saponins was not detected in any of the three extracts. The study shows that all extracts have significant phytochemical profile of the novel plant material (seed shell) of the Mesua ferrea plant. The plant material indicates that it contains most phytochemical ingredients to cure various diseases such as therapeutic activities, anti-inflammatory, anti-cancer, antibacterial activities, etc.

Keywords: *Mesua ferrea, flavonoids,alkaloids, carbohydrates, chloroform, methanol.*

1 INTRODUCTION

Herbal medicine is gaining popularity in developed countries as an alternative to conventional drugs and/or as a natural remedy to traditional drugs.Traditional medicinal practices using plants to treat diseases still exist today in many parts of the world. These practices have evolved over time and have been passed down from generation to generation. Therefore, these plants play an essential role in

daily life and are closely associated with a variety of events related to lifeand death. [1, 2]. On the other hand, these plants need further research to better understand their properties, especially their efficacy and safety. Thus, there is a need for a comprehensive study of medicinal herbs. Medicinal plants contain numerous types of naturally occurring chemical components that contribute to their therapeutic capabilities. With the development of scientific studies, researchers have managed to discover many phytochemical compounds in medicinal plants. These phytochemical compounds have been shown to exhibit a variety of physiological effects and are used for preventive measures [3].The constituents of phytochemicals are so named because they have metabolic activity in plants.Terpenoids, anthraquinones, saponins, cardiac glycosides, flavonoids, alkaloids, steroids, phlobatannins, tannins, and reducing sugars are the major phytochemical constituents found in medicinal plants [4, 5]. The primary constituents of phytochemicals are mainly carbohydrates, chlorophyll, proteins, and amino acids while the secondary constituents are mainly alkaloids, flavonoids, tannins, phenolic, and saponins compounds and various microbial components [6, 7]. Mesua ferrea is an important ethnobotanical plant. Currently, much research is being conducted to learn even more about the many uses of Mesua ferrea, although it has been used for a long time[8,9].The plant materials of Mesua ferrea, such as bark, leaves, and oil, have significant market value due to the commercial production of the seed oil, which is used for skin infections, scabies, wounds, sore eyes, and so on [10, 11].

Most of the leaves, roots, stem barks, and fruits studied for their phytochemical properties were leaves. No previous reports on the phytochemical composition of the seed coat of Mesua ferrea can be found in the scientific literature. Therefore, in the current study, the phytochemical composition of the seed shell of Mesua ferrea plant material was carried out.

2 Methodology

2.1 Plant material The tree Mesua ferrea, often called Ceylon ironwood, belongs to the family Caryophyllaceae and is known by its common name. In the tribal region of Visakhapatnam district in Andhra Pradesh, India, the seed coat of the plant has been collected.

2.2 Chemicals

The purity level of the substances used in this study was 99.99%. The chemicals were obtained for the study from the local chemical stores and the departments of chemistry and pharmacy of GITAM Deemed to be University, Visakhapatnam.

2.3 Extract preparation

The plant material of Mesua ferrea was collected and then dried in the shade. After the leaves were dried, they were ground into a powder. To isolate the main constituents of the medicinal plant, extraction methods were used with three different solvents, namely methanol, hexane and chloroform, and the extraction was carried out using an ultrasonic device at a frequency of 30 kHz for 40 minutes while the temperature was maintained at 45oC. The supernatants were separated by filtration and then dried in vacuum. Further, a desiccator was used to keep the extract concentrates from drying out, and the percent yield was determined. The temperature of the crude extracts is kept at 4oC until they are used.

2.4 Phytochemical screening

To discover and separate the therapeutic, conducting chemicals and components from the plant parts, scientists have turned to the underlying phytochemical properties of plants.The phytochemical properties of plants help to identify their different biological activities.Standard procedures were used to conduct the preliminary phytochemical study of the extracts of Mesua ferrea.

2.4.1 Estimate of total flavonoid content

Shinoda's test for flavonoids

After about half of each part was dissolved in ethanol, heated, and then filtered. After stirring the mixture, a few drops of strong hydrochloric acid were added, followed by the addition of three pieces of magnesium chips. The presence of flavonoids can be detected by their coloration, which can range from pink to orange and red to purple.

Ferric chloride test for flavonoids

An equal amount of each part was brought to a boil with distilled water and the resulting liquid was filtered. Then, a few drops of a 10% ferric chloride solution were added to 2 ml of the filtrate. The presence of a phenolic hydroxyl group was designated by a coloration that was either green-blue or purple.

Sodium hydroxide test for flavonoids

After dissolving a tiny amount of each piece in water and filtering the mixture, a yellow coloration was obtained by adding 2 ml of an aqueous sodium hydroxide solution with a concentration of 10%. After addition of weak hydrochloric acid, the solution turned from yellow to colourless, which is a telltale sign of the presence of flavonoids.

2.4.2 Test for alkaloids

After a minute portion of each component was stirred with 5 ml of 1% aqueous HCl while the mixture was heated in a water bath, the mixture was filtered. 1 ml of the filtrate was added to each of the two test tubes. After adding a few drops of Dragendorff's reagent to the first portion, which was then viewed, it was determined that the presence of an orange-red precipitate indicated a positive result. Mayer's reagent was added to the second part of 1 ml and the presence of a precipitate with a pale hue is evidence that alkaloids are present, as the precipitate was formed.

2.4.3 Molisch's test for Carbohydrates

Each of the components dissolved in distilled water received a few drops of Molisch reagent in a further step. Then one milliliter of concentrated hydrogen peroxide was applied to the side of the test tube. After allowing the mixture to stand undisturbed for two minutes, it was diluted with 5 ml of distilled water. A good result indicates that a red or dull purple colour has formed at the interphase of the two layers.

2.4.4 Fehling's test for free reducing sugar

Each piece was dissolved in approximately 0.5 g of filtered distilled water and then filtered again. During heating, 5 ml each of Fehling's solutions A and B were added to the filtrate in equal parts. You can determine whether or not reducing sugars are present by observing the formation of a red precipitate of copper oxide.

2.4.5 Test for Tannins

After mixing about 0.5 g of each component with about 10 ml of distilled water, the resulting mixture was filtered. 2 ml of the filtrate were added to a ferric chloride solution at a concentration of one percent. Tannins are present when a blue-black, green, or blue-green precipitate is seen after analysis of a sample.

2.4.6 Borntrager's Test

Shaking about 0.2 gram of each sample to be tested with 10 ml of benzene and then filtering the mixture gave accurate results. 5 ml of the ammonia solution at a 10% concentration was then added to the filter and the mixture was shaken. The presence of free anthraquinones can be deduced from the appearance of a pink, red or purple coloration of the ammoniacal phase, as this coloration appears lower in the phase.

2.4.7 Liebermann-Burchard test for steroids

After addition of 2 ml of acetic acid to 0.2 g of each component, the solution was thoroughly

cooled on ice before careful addition of concentrated hydrochloric acid. The development of a hue that changed from purple to blue or blue-green indicated the presence of a steroid ring, also known as the aglycone component of cardiac glycoside.

2.4.8 Test for terpenoids

Ethanol was used to dissolve a small amount of each of the halves. After the addition of concentrated hydrogen peroxide, one milliliter of acetic anhydride was added to this mixture. An indication of terpenoids present was the shift in hue from pink to purple.

2.4.9 Test for saponins

After boiling one gram of each part in 5 ml of distilled water, the resulting mixture was filtered. After about 3 ml of distilled water was added to the filter, it was shaken vigorously for about 5 minutes. It is believed that the existence of saponins can be inferred from the persistent foaming that occurs when the substance is heated.

3 Results and Discussion

The present study was conducted to verify the presence or absence of phytochemicals in the extracts of the seed shell of Mesua ferrea. It was found that different types of phytochemicals were present in all the extracts which are listed in Table 1.

In the course of their secondary metabolic activities, many different plant species form a wide range of alkaloids. Alkaloids belong to a family of nitrogenous compounds.It is clear that the seed shell of Mesua ferrea contained alkaloids (with the hexane and chloroform extracts rather than the methanol extract), and the presence of alkaloids suggests that the therapeutic activities of these plants in humans may be related in part to the alkaloid content of the plants.[4,6]. In most cases, they are developed by plants for defensive, nutritional, and protective purposes against disease-causing organisms and insects that damage plants. Similarly, Flavonoids are important for both human and plant health due to their antioxidant properties. Anti-allergic, cardioprotective, hepatoprotective, anticatactogenic, anti-cancer, anti-inflammatory, antibacterial, antosteoporotic, antidiabetic and antiviral are some of the functions they perform in the body.It can be noted that flavonoids are present in the seed shell of Mesua ferrea with all extracts. Anti-allergic, cardioprotective, hepatoprotective, anticatactogenic, anticancer, anti-inflammatory, antibacterial, antosteoporotic, antidiabetic and antiviral are some of the functions they exert in the body [4, 6].

Tannins are complex polyphenolic compounds formed as secondary metabolites by many different plant species [7].Tannins are associated with a variety of health benefits, including astringent, antibacterial, antiulcerogenic, antiviral, antitumorigenic, antithrombogenic, and anti-inflammatory properties[3,4]. These results suggest that the presence of tannins in the methanol extract of Mesua ferrea seed shell is responsible for the observed therapeutic properties. With other extract tannins could not be detected. Also, the terpenoids were detected in Mesua ferrea seed shell with hexane and methanol extract. They are the main components of essential oils found in many plants. They are produced for the purpose of defence or as signals against indirect defences, such as herbivores and other forms of enemies. These terpenoids have been shown to have anti-inflammatory, antimalarial, anticancer, antibacterial, antiviral, and chemo preventive effects[4, 6].Saponins, one of the most important classes of secondary metabolites, are found in a wide variety of plant species. They are found in virtually all parts of the herbaldomain.Saponins are a type of phytochemicals that can be discovered in a variety of plant foods such as vegetables, beans, and many types of herbs [3, 4].In the current

study, the saponins were not detected in any of the extracts.

Moreover, the phytosterols are natural compounds that can be found in plants. They have the ability to lower cholesterol levels in a safe and effective manner, reducing the risk of adverse health effects such as heart attack and stroke. In addition, there is evidence that they help protect against diseases such as cancer, diabetes and obesity [4, 6]. In the present investigation, the phytosterols were detect for Mesua ferrea seed shell with hexane and chloroform extract except methanol extract. Similarly, the carbohydrates, along with proteins and fats, are one of the three main types of nutrients that can be found in meals and beverages.In this study, the carbohydrates were detected with hexane and methanol extracts from the seed shell of Mesua ferrea. [4, 6]. Finally, the glycosides are another family of phytochemicals produced by plants that have a variety of properties that make them useful in medicine. Glycosides were detected for Mesua ferrea seed shell with hexane and chloroform extract [7, 10].

Table 1 Phytochemical components

Secondary metabolite	Test	Hexane	Chloroform	Methanol
Carbohydrates	Molisch's test Fehling's test	+ +	- -	+ +
Tannins	Ferric chloride test	-	-	+
Phytosterols	Libermann and Buchard test	+	+	-
Terpenoids	Libermann and Buchard test	+	-	+
Flavonoids	Shinoda test Ferric chloride test	- +	+ -	- +
Saponins	Froth formation test	-	-	-
Anthraquinone Glycosides	Borntragers test	+	+	-
Alkaloids	Dragendroff's test Wagners	+ +	+ +	- -

4 Conclusions

The current study was carried out to know the phytochemical constituents present in the ethnomedicinally import plant material (Mesua ferreaseed shell). Based on the investigation, the phytochemical constituents of Mesua ferrea plant material revealed the presence of compounds including carbohydrates, tannins, phytosterols, terpenoids, flavonoids, saponins, anthraquinone glycosides, and alkaloids. Based on the available data, most of the phytochemical components are present in the medicinal plant material of Mesua ferrea. Moreover, these plants have great potential to cure diseases, namely anti-allergic, cardioprotective, hepatoprotective, anticatactogenic, anti-cancer, anti-inflammatory, antibacterial, antosteoporotic, antidiabetic, etc.Based on the findings, the seed shell of Mesua ferrea can be used as a medicinal plant material due to its presence of secondary metabolites.More sophisticated research needs to be done on this medicinal plant material (Mesua ferrea seed shell) to more accurately determine its physiological effects.

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