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Research Article

Qualitative Phytochemical Screening of Selected Medicinal Plants

Mohan E¹, Suriya S², Shanmugam S^{1*}, Rajendran K¹¹ Post Graduate and Research Department of Botany, Thiagarajar College, Teppakulam, Madurai – 625009, Tamil Nadu, India² Department of Botany, Yadava College, Tiruppalai, Madurai – 625014, Tamil Nadu, India

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*Address for Correspondence:

S. Shanmugam, Research Scholar, Post Graduate and Research Department of Botany, Thiagarajar College, 139-140, Kamarajar Road, Teppakulam, Madurai – 625009, Tamil Nadu, India.

Abstract

Phytochemicals have great potency as therapeutic agents. There is continuous and urgent need to discover new therapeutic compounds with diverse chemical structures and novel mechanism of action because there has been an alarming increase in the incidence of new and re-emerging infectious diseases. Hence, the present investigation was carried out to assess the phytoconstituents of leaf extracts of four different medicinal plants viz. *Acorus calamus*, *Senna alata*, *Solanum torvum* and *Solanum trilobatum*. The leaves of four plants were collected from their wild habitats, washed, air dried and then powdered. The solvent extracts of the respective leaves were prepared using Soxhlet apparatus with acetone, ethanol and petroleum ether. The extracts were subjected to preliminary phytochemical analyses as per standard procedures. The results showed that alkaloids were present in all the four plants analyzed and all the three solvents extracted. Meanwhile, carbohydrates and proteins were absent in the same. It was also indicated that the ethanol extract of *Solanum trilobatum* leaf showed the presence of 7 compounds among 9 phytochemicals analyzed. The result of this study is encouraging further quantitative estimation and the need for clinical studies to determine the potential effectiveness of particular phytochemical *in vivo*.

Keywords: Preliminary phytochemical analyses, *Acorus calamus*, *Senna alata*, *Solanum torvum* and *Solanum trilobatum*.

1. INTRODUCTION

Plant-derived substances have recently become of great interest owing to their versatile applications. Medicinal plants are a group of species that accumulate different active principles, useful in treating various human or animal diseases. They 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 drugs¹.

Phytochemicals are naturally occurring in different parts of the medicinal plants that have defense mechanism and protect from various diseases². The medicinal plants are useful for healing as well as for curing of human diseases because of the presence of phytochemical constituents which produce definite physiological action on the human body and these bioactive substances include alkaloids, carbohydrates, terpenoids, steroids, flavonoids, tannins, etc.³.

Plants with prospective medicinal activity have recently come to the attention of scientists and researchers because of their bioactive potential. Preliminary screening of phytochemicals is a valuable step in the detection of the

bioactive principles present in medicinal plants and subsequently may lead to drug discovery and development. Due to the significance in this above perspective, such preliminary phytochemical screening of plants is the need of the hour in order to discover and develop novel therapeutic agents with improved value. Thus, the present study was aimed to assess the various phytoconstituents present in the leaf extracts of selected medicinal plants such as *Acorus calamus*, *Senna alata*, *Solanum torvum* and *Solanum trilobatum* and these plants were selected based on their ethnomedicinal importance⁴⁻⁷.

2. MATERIALS AND METHODS

2.1. Plant sample collection

The healthy leaves of *Acorus calamus* L. (Acoraceae – Vasambu), *Senna alata* (L.) Roxb. (Fabaceae – Seemaiagathi), *Solanum torvum* Sw. (Solanaceae – Sundaikkaai) and *Solanum trilobatum* L. (Solanaceae – Thoodhuvalai) were collected from their natural habitats in Kathakinaru village (9.9865° N latitude and 78.1717° E longitude) of Madurai district in Tamil Nadu, India, and brought to the laboratory. The leaves were washed separately with tap water and shade dried at room temperature to attain constant weight. The air dried samples were powdered in an electric blender

and stored in plastic bags for further analysis. All the plants were botanically confirmed and authenticated as per APG IV classification ⁸.

2.2. Preparation of plant extract

The dried powder material was extracted sequentially in three different solvents viz., acetone, ethanol and petroleum ether. 15 g of the dried and powdered plant material were extracted with 150 ml of ethanol, acetone and petroleum ether using soxhlet apparatus for 6-8 hours at a temperature not exceeding the boiling point of the solvents. The obtained crude extracts were filtered by using Whatman No. 1 filter paper and then concentrated under vacuum at 40° C by using a rotary evaporator and later stored at 4° C for further use.

2.3. Qualitative phytochemical analysis

Preliminary phytochemical analyses were carried out on the leaf extracts of *Acorus calamus*, *Senna alata*, *Solanum torvum* and *Solanum trilobatum* in order to determine the presence of different phytochemicals like alkaloids, carbohydrates, flavonoids, glycosides, phenols, phytosterols, proteins, saponins and tannins by subjecting the following standard procedures for respective phytochemical. Mayer's test for alkaloids ⁹, Fehling's test for carbohydrates ¹⁰, Alkaline reagent test for flavonoids ¹¹, Keller-Killiani test for glycosides ¹², Ferric chloride test for both phenols and tannins ¹³, Salkowski test for phytosterols ¹², Biuret test for protein ¹⁴ and Foam test for saponins ¹³. The qualitative results were expressed as (+) for the presence and (-) for the absence of phytochemical.

3. RESULT AND DISCUSSION

The results regarding the phytochemical screening of *Acorus calamus* leaf, alkaloids, glycosides, phytosterols and saponins were found to be present in acetone extract, alkaloids and saponins were present in ethanol extract, and alkaloids, flavonoids, phytosterols and saponins in petroleum ether extract. All the three extracts showed the presence of alkaloids and saponins, and absence of carbohydrates, phenols, proteins and tannins. Most number of phytochemicals (4) were found to be present in both acetone and petroleum ether extract than that of ethanol (Table 1).

Table 1: Preliminary phytochemical screening of *Acorus calamus* leaf

Phytochemical	Solvent extract		
	Acetone	Ethanol	Petroleum ether
Alkaloids	+	+	+
Carbohydrates	-	-	-
Flavonoids	-	-	-
Glycosides	+	+	-
Phenols	-	-	-
Phytosterols	-	-	-
Proteins	-	-	-
Saponins	-	-	-
Tannins	-	+	+

In case of *Senna alata* leaf revealed that acetone extract covered the presence of alkaloids and glycosides, ethanol extract showed the presence of alkaloids, glycosides and tannins, whereas the petroleum ether extract exposed the presence of alkaloids and tannins. In all the three extracts, alkaloids were present and carbohydrates, flavonoids, phenols, phytosterols, proteins and saponins were found to be absent. Of all the phytoconstituents analyzed, most of the compounds (3) were detected in ethanol extract than others (Table 2).

Table 2: Preliminary phytochemical screening of *Senna alata* leaf

Phytochemical	Solvent extract		
	Acetone	Ethanol	Petroleum ether
Alkaloids	+	+	+
Carbohydrates	-	-	-
Flavonoids	-	-	-
Glycosides	+	+	-
Phenols	-	-	-
Phytosterols	-	-	-
Proteins	-	-	-
Saponins	-	-	-
Tannins	-	+	+

In *Solanum torvum* leaf extracted with acetone, alkaloids, phytosterols, saponins and tannins were found to be present. The ethanol extract of the same showed the presence of alkaloids, flavonoids, phytosterols and saponins, and petroleum ether extract revealed the presence of alkaloids, glycosides, phytosterols and saponins. Alkaloids, phytosterols and flavonoids were found to be present in all the three solvents and carbohydrates, phenols and proteins were absent. Among the phytochemicals tested, all the three solvents exposed 4 compounds each (Table 3).

Table 3: Preliminary phytochemical screening of *Solanum torvum* leaf

Phytochemical	Solvent extract		
	Acetone	Ethanol	Petroleum ether
Alkaloids	+	+	+
Carbohydrates	-	-	-
Flavonoids	-	+	-
Glycosides	-	-	+
Phenols	-	-	-
Phytosterols	+	+	+
Proteins	-	-	-
Saponins	+	+	+
Tannins	+	-	-

The results of preliminary phytochemical screening of *Solanum trilobatum* leaf indicated that acetone extract exposed the presence of alkaloids, flavonoids, glycosides, phenols, saponins and tannins. However, ethanol extract revealed the presence of alkaloids, flavonoids, glycosides, phenols, phytosterols, saponins and tannins, whereas the petroleum ether extract highlighted the presence of alkaloids, flavonoids, phenols, saponins and tannins. Alkaloids, flavonoids, phenols, saponins and tannins were detected in all the three solvent, on other hand carbohydrates and proteins were non-detected. More number of compounds (7) were found to be present in ethanol extract than other two solvents (table 4).

Overall findings of the present study highlighted that alkaloids were present in all the four plants analyzed and all the three solvents extracted. Meanwhile, carbohydrates and proteins were absent in the same. Regarding the number of compounds detected, the ethanol extract of *Solanum trilobatum* showed the presence of 7 phytochemicals as highest, and acetone, petroleum ether extracts of *Senna alata* and ethanol extract of *Acorus calamus* revealed the presence of 2 compounds each as least (Fig 1).

Table 4: Preliminary phytochemical screening of *Solanum trilobatum* leaf

Phytochemical	Solvent extract		
	Acetone	Ethanol	Petroleum ether
Alkaloids	+	+	+
Carbohydrates	-	-	-
Flavonoids	+	+	+
Glycosides	+	+	-
Phenols	+	+	+
Phytosterols	-	+	-
Proteins	-	-	-
Saponins	+	+	+
Tannins	+	+	+

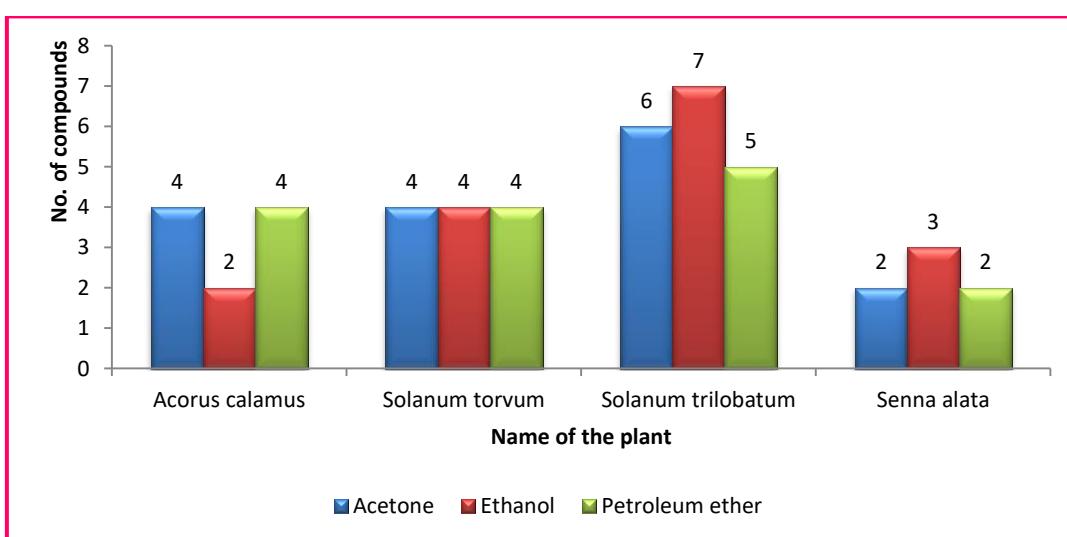


Figure 1: Number of compounds detected in respective plants and solvent extracts

From the findings of current research work, it was also clearly known that most of phytoconstituents were detected in ethanol extract than that of acetone and petroleum ether extracts. This can be attributable to the higher solubility of the phytocompounds of plant material in ethanol than other solvents. The recovery of phytochemical from plant sample could also be influenced by dielectric constant, chemical structure of solvents used, and as well as chemical properties of phytochemicals¹⁵.

The preliminary phytochemical screening of the four medicinal plants selected for this present study showed that they own their phytoconstituents and such phytochemicals have several important biological activities. It was reported that alkaloids have the pharmacological activities like antimicrobial¹⁶, antiarrhythmic, analgesic¹⁷ and antihyperglycemic¹⁸ activities. It was known that flavonoids possesses alpha-glucosidase activity¹⁹, antioxidant activity²⁰ and anti-inflammatory activity²¹.

Phenolic compounds are also known for their anti-inflammatory^{22,23}, antimicrobial²⁴⁻²⁶, and antioxidant^{27,28} effects. Saponins exhibit a variety of biological activities like

anti-inflammatory²⁹, hypocholesterolemic³⁰ and immune-stimulating³¹, insecticidal and antimicrobial properties³², antidiabetic³³, cytotoxic³⁴ and central nervous system activities^{35,36}. Tannins have been reported to have various physiological effects like anti-irritant, antiparasitic effects³⁷. These research evidences strongly justify the medicinal usage of leaves of *Acorus calamus*, *Senna alata*, *Solanum torvum* and *Solanum trilobatum* as they contained the above mentioned biologically important phytochemicals detected by the present study.

4. CONCLUSION

Further quantitative and chromatographic studies should be carried out on the phytochemical compounds present in *Acorus calamus*, *Senna alata*, *Solanum torvum* and *Solanum trilobatum* to isolate, identify, characterize and elucidate the structure of the bioactive compounds. There may be a chance to discover a new compound which leads to the birth of new drug. Biological efficacies of the isolated compounds should also be tested using animal models.

CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

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