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SOLANUM ERIANTHUM; ANALYSIS OF PHYTOCHEMICAL COMPOSITION

Ramya Urs S. K. and N. Lakshmidevi*

DOS in microbiology, University of Mysore, Manasagangothri, Mysore-570006.

***Correspondence for Author: N. Lakshmidevi**

DOS in microbiology, University of Mysore, Manasagangothri, Mysore-570006.

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Abstract

Solanum erianthum is a medicinal plant traditionally used all over the world to treat various human ailments. There is a very limited data available on phytochemical profile of Solanum erianthum. The present study evaluates complete phytochemical profile of the plant using standard methods. The results of the qualitative phytochemical analysis indicated the presence of saponins, tannins, alkaloids, steroids in the plant. The quantitative analysis showed the phytochemical groups present were in a significant amount viz., saponins (30.2 mg/g), tannins (45.9 µg/mg), flavanoids (148 µg/mg) and alkaloids (120µg/mg). The study supports Solanum erianthum as a good source of phytochemicals with potential pharmacological value.

KEYWORDS: Solanum erianthum, phyochemicals, qualitative and quantitative analysis, medicinal plant.

INTRODUCTION

India is well known for its rich knowledge on the usage of medicinal plants to treat various human ailments. Ayurveda is one of the world's oldest systems of medicine which depends on the medicinal plants and its extracts to treat the diseases.[1] Though there is a much data available on the importance of medicinal plants as treating agents, there is a very small percentage of the available plants have been validated for their pharmacological value. Pharmacological approach depends on screening the target plants for their phytochemical constituents, to depict the medicinal importance of the particular plant.[2] Solanum erianthum belongs to a family called Solanaceae and is one of the varieties of nightshade plants. The plant is a native of southern North America and is commonly called as potato tree, velvet nightshade and salvadord.[3] The plant is considered as a weed because of its wide favorable habitats, which include forests, waste places, roadside and fields. The present investigation is an approach to validate the plant for its medicinal values. The plant has shown various pharmacological activities, the present study analyses the phytochemical composition of the plant.

MATERIALS AND METHODS

Sample collection and preparation of the extract:

The plant sample was collected from the Kushalnagar, Karnataka in the month of August. The plant was authenticated by Prof. Shivakumar, Head of the department, Department of Botany, J.S.S Women's college, Sarawathipuram, Mysore.

The collected plant was washed in tap water and it was dried in shade by keeping overnight in a hot air oven at 60^{o} C. After drying the sample was grinded in a grinder by avoiding overheating.

Phytochemical screening

1. Qualitative screening

The plant was subjected to preliminary phytochemical screening to test for qualitative phytochemical composition by the methods reported by Trease and Evans (1987) and Harbone (1973).

Detailed procedure for the qualitative analysis is given under respective head.

Test for carbohydrates

2ml of the extract was taken in a test tube and 2 drops of freshly prepared 10% alcoholic alpha naphthol was added mixed well and 2 ml of conc. sulphuric acid was added from sides of the test tube. The formation of the violet ring at the junction of the two liquid was observed for the positive result.

Test for the protein

To 1 ml of the extract 4% sodium hydroxide and few drops of 1% copper sulphate was added. Appearance of violet red color indicates the presence of protein.

Test for amino acids

3 drops of 5% ninhydrin was added to 3 ml of the extract in the test tube and heated in boiling water bath for 10 min. Formation of purple or bluish color indicates the presence of amino acid.

Test for glycosides
3 ml of the extract was treated with concentrated sulphuric acid, boiled and filtered. The resulting solution was cooled to room temperature and was treated with chloroform (equal volume) and shakeed. The organic layer formed was separated and treated with liquid ammonia. Pinkish color of ammonical layer indicate the presence of glycosides.

Test for saponins
0.5g of the extract was added to 5ml of distilled water. The solution was shaken vigrousouly and observed for a stable persisitent froth. The frothing was mixed with 3 drops of olive oil and shaken vigourously after which it was observed for the formation of an emulsion.

Test for alkaloids
To the extract was treated with few drops of dragendroff's reagent and formation of orange brown precipitate indicated the presence of alkaloids.
Test for steroids: 0.5 gm of the sample was taken and 2ml of chloroform and 2ml of concentrated sulphuric acid was added and shaken well. The red colour at lower layer indicated presence of steroids.
Test for tannins: 0.5 g of the plant sample was boiled in 10ml of water in a test tube and then filtered. A few drops of 0.1% ferric chloride was added. Development of brownish green indicated the presence of tannins.

Test for terpenoids: 0.5 g of extract was taken and 2ml of chloroform was added. Concentrated sulphuric acid about 3ml was carefully added to form a layer. Reddish brown colouration in the interface indicated the presence of the terpenoids.
Test for flavonoids: 0.5 gm of the sample was heated with 10ml of ethyl acetate over a steam bath for 3 min. The mixture was filtered and 4ml of the filtrate was shaken with 1 ml of dilute ammonia. Appearance of yellow colour indicated the presence of flavonoids.

2. Qunatitative phytochemical analysis
Total phenolics: Total phenolic content of the plant leaf was assayed by the method described by Folin Ciocalteu [4]. In brief, various aliquots of aqueous methonolic extract (10 mg/ml) were mixed with 5 ml Folin–Ciocaleu reagent and 4 ml of sodium carbonate (75 g/l). The resulting solution was vortexed and incubated at 40^0C for 30 min. The absorption was read at 765 nm. A calibration curve was prepared by using gallic acid as standard. All determinations were performed in triplicate. The total content of phenolic compounds in plant methanol extracts in gallic acid equivalents (GAE) was calculated by the following formula:

$$A = 0.980 + 9.92X \times 10.3$$

Where, A is the absorbance and C is the Concentration as gallic acid equivalents (µg/ml)

Flavonoids
The content of flavonoids was determined by a pharmacopeia method[5] using rutin as a reference compound. For brief, one gm of sample was extracted with aqueous methanol and 1ml of the extract was mixed with 1 ml aluminium trichloride in ethanol (20 g/l) and diluted with ethanol to 25 ml. The absorption at 415 nm was read after 40 min at 20 C. Blank samples were prepared from 1 ml plant extract and 1 drop acetic acid, and diluted to 25 ml. A standard graph was constructed using rurtin as the reference standard using the above method. All determinations were carried out in triplicate. The amount of flavonoids in plant extracts in rutin equivalents (RE) was calculated by the following formula.

$$X = \frac{A \times Mo \times 10}{Ao \times m}$$

Where, X- Flavanoids content (mg/g) plant extract in rutin equivalents, A-Absorbance of the Sample, Ao-Absorbance of the standard, m- Weight of the sample in mg, Mo- Weight of rutin in the solution.

Estimation of Total Alkaloids
Alkaloids were estimated by the gravimetric method.[6] The sample **(**0.5 gm) was taken in 250 ml beaker and 200 ml of acetic acid (10%) in ethanol was added and incubated at room temperature for 10 h. The resulting solution was filtered and the extract was concentrated on a water bath to one quarter of the original volume. To the Concentrate, concentrated ammonium hydroxide was added drop wise until the precipitation was complete. The above solution was allowed to settle and the precipitate was collected and washed with dilute ammonium hydroxide and filtered. Thus resulting alkaloid precipitate was dried, weighed and expressed in alkaloids per gm of sample taken.

Estimation of Saponins
The Saponin content was analyzed according to gravimetric method.[7] In brief, 250 ml of 20% ethanol was added to 10 g of the pulverized leaf powder and stirred at 55° C using a magnetic stirrer for 12 h. The resulting solution was filtered using Whatman No 1 filter paper and reduced to 40 ml under vacuum and 20 ml Diethyl ether was added in a separating funnel and shaken vigorously. The pH of the aqueous layer was adjusted to 4.5 by adding HCl, where as the ether layer was discarded. To the pH adjusted aqueous part was extracted with 60 ml of n-butanol. The Butanol extract was washed twice with 10ml of 5 % NaCl and evaporated to dryness to give a crude saponin which was weighed and expresses in mg/g sample.

Estimation of Tannins
Tannins were estimated according to spectroscopic method described by Trease & Evans,[8] 5 g of the leaf powder was extracted with 50 ml of boiling water and filtered. 0.5ml of the filtrate was added to 0.5 ml of 0.5M ferric solution in an alkaline medium and allowed to

stand for 30 minutes for color development. The absorbance was read at 760 nm and the amount of tannin was extrapolated from a standard calibration curve for tannic acid.

RESULTS

Qualitative Screening

The qualitative assays indicated the presence of saponins, steroids, tannins, terpenoids and flavonids in the methanol extract of the leaf (Table.1).

Table 1. Phytochemical properties result

Chemical	Hexane	Ethyl acetate	Acetone	Methanol	Aqueous
Carbohydrates	-	-	-	-	-
Proteins	-	-	-	-	-
Glycosides	-	-	-	-	-
Saponins	-	-	-	+	+
Alkaloids	-	-	+	+	+
Steroids	+	+	+	-	-
Tannins	-	-	-	+	+
Terpenoids	-	-	-	-	+
Flavonids	-	+	+	+	-

*The positive sign indicates the presence of respective phytochemical group.

Quantitative composition

The quantity of the individual group of phytochemicals present in the plant is given in Table 2. The results are expressed in units per gram of the plant sample.

Table 2. Quantitive composition of phytochemicals

Group	Quantity present
Total polyphenols (mg/g)	193 ±5.2
Flavanoids (µg/mg)	148±4.9
Saponins (mg/g)	30.2±1.2
Tannins (µg/mg)	45.9±0.5
Alkaloids (µg/mg)	120±2.1
α-Tocopherol(µg/g)	20.4±1.2
β-Carotene(µg/mg)	4.2±0.6

*The values presented are mean of triplicate experiments with standard deviation

DISCUSSION

Solanum erianthum is widely used as traditional medicine to treat various ailments, though there are studies on the phytochemical composition of the Solanum erianthum, there is only a limited data available on the complete qualitative and quantitative phytochemical composition of the plant. Hence the present study was planned to completely analyze the qualitative and quantitative phytochemical composition. Polyphenols are metabolic intermediates produced by plants. It has been reported that the regular consumption of the polyphenols have beneficial effect on various chronic disorders such as cardiovascular disease, diabetes and cancer.[14] Flavonoids have been found to play a key role in many beneficial physiological actions such as anti-oxidant, anti-atherosclerotic, anti-inflammatory, antitumor, anti-osteoporotic and antiviral activities. They have been found to show insignificant toxic effects in animal models.[15] The saponins are chemically surface-active glycosides, which have been reported to be immunostimulant, hypocholesterolaemic and anticarcinogenic in In-vitro, ex-vivo and In-vivo models.[22] The results of the quantitative assays shows that the plant is blessed with a significant amount of various phytochemical groups Viz., polyphenols, alkaloids, tannins, saponins and steroids. The presence of all the phytochemical groups in a considerable amount indirectly shows the pharmacological significance of the medicinal plants, thus it can be claimed that Solanum erianthum is pharmacologically worth plant and can be further screened for various pharmacological effects.

Significance of the study

The present study has laid a platform for in depth pharmacological assays by analyzing the complete phytochemical groups present in the plant.

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