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Phytochemical and histochemical studies on *Solanum diphyllum* L.- An exotic potent weed

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Abstract

Plant-based substances are seeking attention due to their substantial medical benefits. Medicinally, as well as in terms of poisoning and psychotropic effects, members of the family Solanaceae have been of great importance and used throughout history. The present study mainly focuses on the identification and location ofan important exotic plant species*Solanumdiphyllum* L. proven to be a potentially fast-spreading weed being reported from various states of South India and the detection of important biologically active chemical compounds in the same to look into the discovery of new herbal formulations and their curative properties for treatment of common ailments.

Keywords: Phytochemical, histochemical, *S. diphyllum* L.

1.Introduction

*Solanum diphyllum*L. is commonly known as the two-leaf nightshade belonging to the Dogbane family Solanaceae. A species native to Mexico and Central America currently escaped from cultivation as an ornamental plant; it grows wild as a naturalized exotic plant in many places around the world. It was first reported for India from Kolkata by Paul and Biswas (Biswas and Paul, 1995). Further during the revisionary work of the family Solanaceae for Flora of India project, it was reported as an addition to the flora of Maharashtra, Karnataka and Tamil Nadu (Kumari, 2004; Kumari, 2013).

The plant is a perennial, woody, attractive shrub. Leaves are 1-2' dark green and shiny, in unequal pairs, one large and elliptical, the other small and round. The petioles are about 2mm in length. In warmer months, the plant produces clusters of tiny white, five-petal flowers. Fruits are black-seeded green berries that ripen to bright yellow-orange attracting sweet loving insects and birds. Inflorescences are borne opposite to the leaves. The seeds are flat, kidney-shaped, each about 3mm long.

2. Materials and methods

The plant material was collected from the vicinity of Maharani Lakshmi Ammanni College for Women Autonomous. It was authenticated by Dr M. Reema Kumari, Assistant Professor, Dept. of Botany, mLAC Autonomous, Bengaluru. A herbarium was prepared and deposited in the Dept. of Botany for further reference.

2.1. Solvent Extraction

The stem and roots were shade dried and powdered with the help of an electric grinder till a fine powder was obtained. The powdered material was stored in airtight containers and further subjected to soxhlet extraction using a soxhlet apparatus with ethanol and water as solvents. As per the standard soxhlet procedure, the stem extract was obtained. The filtrate from root powder was obtained by boiling in water and filtering through Whatsman filter paper. The extracts were stored in sterile glass vials at 5^0C.

2.2. Preliminary phytochemical screening

The following phytochemical tests were conducted. Mayer's test and Dragendroff's test for **Alkaloids,** Benedict's test and Fehling's test for **Carbohydrates,** Modified Borntrager's test for **Glycosides,** Foam test for **Saponins,** Salkowski's test and Libermann Burchard's test for **Phytosterols,** Ferric chloride test for **Phenols,** Alkaline reagent test and Lead acetate test for **Flavonoids,** Xanthoproteic test for **Proteins and Amino-acids.**

2.3. Histochemical analysis

Free-hand microscopic sections of stem and leaves from the fresh plant material were taken and the sections were further subjected to different tests. The microscopic staining observations for the presence or absence of histochemicals

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were recorded (Paech and Tracey, 2013).

2.4. Presence of carbohydrates

2.4.1. Starch test by Iodine-Potassium Iodide reaction (Ruzin, 1999). The sections were mounted in the iodine-potassium iodide solution. (The solution was made by dissolving 2g of potassium iodide in 100mL of water and then dissolving 0.2g of iodine in the potassium iodide solution).

2.4.2. Callose test using the Soda method (Chamberlain, 2015). The sections were placed in a 4% aqueous solution of soda for 10 minutes. Then they were transferred to glycerine and mounted.

2.5. Presence of total proteins

Mercuric bromophenol blue method (Snedden, 2008). Sections were immersed in the dye solution for 15 minutes (10g of mercuric chloride and 100mg of bromophenol blue dissolved in 100mL of water). Then they were washed for 20 minutes in 0.5% acetic acid which removes the excess dye). After that, they were washed in water for 15 minutes, dehydrated and mounted.

2.6. Presence of minerals

2.6.1. Test for calcium-Von Kossa's silver nitrate method (Suvarna, 2012). The sections were immersed in 5% aqueous solution of silver nitrate for 60 minutes in bright sunlight (but not directly exposed). They were washed in distilled water. Then they were counterstained for 1 minute in 0.5% aqueous safranin, dehydrated and mounted.

2.6.2. Test for tannins-Lugol's Iodine solution method (Haridas, E. T., and N. Suresh Kumar, 1985)***:*** Sections were treated in Lugol's iodine solution (4g iodine, 6g potassium iodide, and 100ml distilled water). To this, a drop of ammonium hydroxide solution was added (10ml of ammonium hydroxide in 90ml distilled water). The sections were then observed.

3. Results and discussion

The solvent extraction from the stem and root of *S. diphyllum* was carried out using ethanol and water to extract the maximum soluble components. The Table - I, which represents the results of phytochemical tests show the presence of carbohydrates, glycosides, phytosterols, flavonoids, and proteins which are of importance in antimicrobial and antidiarrheal activities. Glycoside is effective against cancer and possesses membrane permeability properties, which acts on the tumour cells. The presence of protein brings about the antiviral property of the plant. Polypeptides block viral fusion or adsorption, forms disulfide bridges.

According to the histochemical studies, the stem of *S. diphyllum* showed the presence of starch, proteins, calcium, and tannins. Callose was absent. Similarly, the leaf showed the presence of mucilage cells i.e. idioblasts. Whereas starch, callose, proteins, calcium, and tannins were not seen present in

Table I: Result of Phytochemical tests for Stem and Root extract of S. diphyllum L.

Test	Stem Extract		Root Extract
	Ethanol	Water	Water
1)Detection Of Alkaloids			
Mayer's Test	-	-	-
Dragendroff's Test	-	-	-
2)Detection Of Carbohydrates			
Benedict's Test	+	+	-
Fehling's Test	-	-	+
3)Detection Of Glycosides			
Modified Borntrager's Test	+	-	+
4)Detection Of Saponins	-	-	-
Foam Test			
5)Detection Of Phytosterols			
Salkowski's Test	-	-	+
Libermann Burchard's Test	+	+	-
6)Detection Of Phenols			
Ferric Chloride Test	-	-	-
7)Detection Of Flavonoids			
Alkaline Reagent Test	-	+	-
Lead Acetate Test	-	+	-
8)Detection Of Proteins And Amino-Acids			
Xanthoproteic Test	-	+	-

+= present; - = absent

the leaves.

4. Conclusion

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. Weed control is a serious global issue among agricultural practices and also in terms of the toxicity of newly introduced weeds towards other organisms. In the present study, an attempt was made to investigate the presence of important phytochemicals in stem and root extracts and the presence of various histochemicals in the microscopic sections of leaf and stem of *S. diphyllum* supposed to be a highly toxic weed to humans and mammals. This plant represents a reservoir of effective chemicals and can provide valuable sources of various medicines as well as pesticides.

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Conflict of interest

None stated by authors.

References

Biswas and Paul, T. *Solanum Diphyllum L. - A New Record For India.* Botanical Survey Of India. Howrah (1995) Pp.137-138.

Kumari, R. *Taxonomic Revision Solanaceae Materials Methods*. Bharathiar University. (2004)

Kumari, R. *Solanumdiphyllum (Solanaceae) – A new record for Southern India*. 23rd ed. Rheedea, Bangalore, (2013). Pp.50-51.

Paech, K. and Tracey, M. *Modern Methods of Plant Analysis*. Springer Berlin, Heidelberg. (2013)

Ruzin, S. *Plant microtechnique and microscopy*. Oxford University, Press New York. (1999).

Cmberlain, C. *Methods in plant histology (classic reprint)*. FORGOTTEN Books. (2015).

Chapman, D. *Dichromatism of Bromophenol Blue, with an Improvement in the Mercuric Bromphenol Blue Technic for Protein. Stain Technology*, (1975). 50(1), pp.25-30.

Suvarna, K. *Bancroft's Theory And Practice Of Histological Techniques*, International Edition. Churchill Livingstone. (2012).

Haridas, E. T., and N. Suresh Kumar. "Some techniques in the study of insect host plant interaction." *Dynamics of insect plant interaction, Ento. Res. Inst., Loyolo College, Madras* (1985).