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ANTIOXIDANT, PHYTOCHEMICAL AND ANTIMICROBIAL STUDY OF SOLANUM NIGRUM

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Abstract

The resurgence of herbal medicine in modern healthcare is a reflection of the enduring value of natural remedies. Historically, ancient texts have cataloged approximately 500 plant species with medicinal properties, a number that has grown to about 800 in contemporary practice. India, often referred to as the "botanical garden of the world," is a major cultivator of these medicinal herbs, integrating them into traditional medical treatments across various indigenous systems such as Siddha, Ayurveda, Unani, and Allopathy.

This paper focuses on Solanum nigrum (black nightshade), a plant from the Solanaceae family, traditionally used to treat a range of conditions including pain, inflammation, fever, and gastrointestinal diseases. Despite its widespread use in folklore medicine, S. nigrum has not been extensively studied scientifically. Our research investigates the phytochemical contents and evaluates the antioxidant and antibacterial activities of S. nigrum's berry, leaf, stem, and root extracts. The findings aim to substantiate the therapeutic potential of S. nigrum in managing infectious and chronic diseases, bridging the gap between traditional knowledge and scientific validation.

Introduction:

In recent years, there has been a marked increase in the demand for herbal medicines. This trend is a testament to the enduring legacy of natural remedies in contemporary healthcare. Ancient texts reference approximately **500 plant species** with medicinal properties, while modern practices have expanded this repertoire to include around **800 species**.

India, with its diverse flora, serves as a significant repository of these medicinal plants. These plants form the cornerstone of traditional medical treatments[1].The country's indigenous systems of medicine, including **Siddha**, **Ayurveda**, **Unani**, and even **Allopathy**, utilize a myriad of plant species to address a spectrum of ailments[2]. India is the largest producer of medicinal herbs and is called as botanical garden of the world[3] Plants are like little chemical factories, making lots of different compounds to protect themselves from bugs, germs, and animals that want to eat them. Some of these plant chemicals can be poisonous to their

enemies but can actually help treat human sicknesses. These plant chemicals come in many shapes and form, and a lot of them have a special ring structure made of carbon and hydrogen, called phenols, or their oxygen substituted derivatives. Although phytotherapy continues to be used in several countries, most of the traditional medicinal plants have not received scientific or medical scrutiny. One such medicinal plant, which lacks scientific evidence for its wide folklore use, is S. nigrum. Solanum nigrum is a medicinal plant member of the Solanaceae family of plants. Solanum nigrum commonly known as black nightshade. Solanum nigrum is an erect annual herb. The juice of the plant is diuretic and used to cure chronic enlargement of liver, piles, dysentery and fever. The drug made from this plant acts as laxative, improve appetite and this is administered against asthma, leprosy skin diseases[4]. S. nigrum has been used traditionally to treat various ailments such as pain, inflammation fever, and enteric diseases[5,6,7]. It possesses many activities such as antitumorigenic, antioxidant hepatoprotective and diuretic[8,9].This research delved into the **phytochemical composition** and the **antioxidant and antibacterial properties** of various parts of the S. nigrum plant, including the berry, leaf, stem, and root. The goal was to expand our understanding of its potential benefits in treating both infectious and chronic diseases.

MATERIAL AND METHOD:

Plant Material:

Plant material was collected from District Thane, Maharashtra, India and aerial part of the plant (leaves and stem) selected for the present study. The plant material was washed with water to remove dust and dried under shadow. Dried plant material then converted into fine powder using grinder and powdered material is then stored in an air tight container at 5^{O}C.

Preparation of extract:

The dried powder was subjected to Soxhlet extraction using ethanol, pet.ether, ethyl acetate, ethanol and water. The extracts were filtered. The extracts obtained were evaporated in a rotary evaporator at reduced pressure to get a solid mass. It was stored below 4°C until further use.

Preliminary Phytochemical Analysis:

Following phytochemical tests were performed to get complete picture of phytochemical screening[10, 11, 12].

Test for Alkaloids Dragendorff's Test:

Few mg of extract of the drug dissolved in 5 ml of water added 2 M hydrochloric acid until an acid reaction occurred; 1 ml of dragendorff's reagent (potassium bismuth iodide solution) was added an orange red precipitate indicated the presence of alkaloids.

Test for Steroids and Sterols Liebermann's Burchard reaction:

The test extract solution was dissolved in 2 ml of chloroform in a dry test tube. Now 10 drops of acetic anhydride and 2 drops of concentrated sulphuric acid were added. The solution became red, then blue and finally bluish green in color.

Test for Glycosides Legal's test:

Extract solution dissolved in pyridine then sodium nitroprusside solution was added to it and made alkaline. Pink red colour indicated the presence of glycosides.

Test of Saponins:

1 ml of alcoholic extract was diluted with 20 ml distilled water and shaken in graduated cylinder for 15 minutes. One cm layer of foam indicated the presence of saponins.

Test for Flavanoids Shinoda test:

In the test tube containing alcoholic extract of the drug added 5 - 10 drops of dil. hydrochloric acid followed by the small piece of magnesium. In presence of flavonoids a pink, reddish pink or brown color was produced.

Test for Tannins:

To the sample of the extract, ferric chloride solution was added appearance of dark blue or greenish black colour indicated the presence of tannins.

Test for Triterpenoids:

In the test tube, 2 or 3 granules of tin was added, and dissolved in 2 ml of thionyl chloride solution and test solution was added. Pink colour was produced which indicates the presence of triterpenoids.

Test for Protein and Amino acid Biuret's test: To 2 - 3 ml of the extract of drug added in 1 ml of 40 % sodium hydroxide solutions and 2 drops of 1 % copper sulphate solution mix thoroughly, a purplish - violet or pinkish - violet colour produced that indicates the presence of proteins.

Test of Resins: Dissolved the extract in the acetone and pore the solution in the distilled water. Turbidity indicated the presence of resin.

Test of Fats or Fixed oils:

The extract was mixed in one ml 1 % of copper sulphate solution then added 10 % sodium hydroxide solution a clear blue solution was obtain which showed glycerin present in sample

Test for Carbohydrates (Molisch's test):

In a test tube containing extract of drug, added two drop of freshly prepared 20% alcoholic solution of α- naphthol and mixed concentrated sulphuric acid along the sides of the test tube. If carbohydrate present purple color or reddish violet color produce at the junction between two liquids.

Antioxidant activity of extracts of Solanum nigrum against DPPH radicals:

DPPH (1 ml of 0.135 mM) prepared in methanol was mixed with 1.0 ml of aqueous extracts (0.025-0.5 mg/ml). The reaction mixture was vortexed thoroughly and left in the dark at room temperature for 30 min., the absorbance was measured at 517nm. The same procedure is repeated for ethanol extract[13].

The scavenging activity of plant extracts was calculated as follows:

% DPPH inhibition = Abs (control) – Abs (sample)/Abs (control) x 100.

Where Abs (control) is the absorbance of DPPH radical + methanol, and Abs (sample) is the absorbance of DPPH radical + sample (extract or standard)**.**

Result and Discussion:

The phytochemical analysis of S. nigrum leaves extract is presented in Table 1. The S. nigrum extracts in different solvents werte found to contain alkaloids, flavonoids, saponins, tannins, triterpenoids, glycosides, and Phenols.

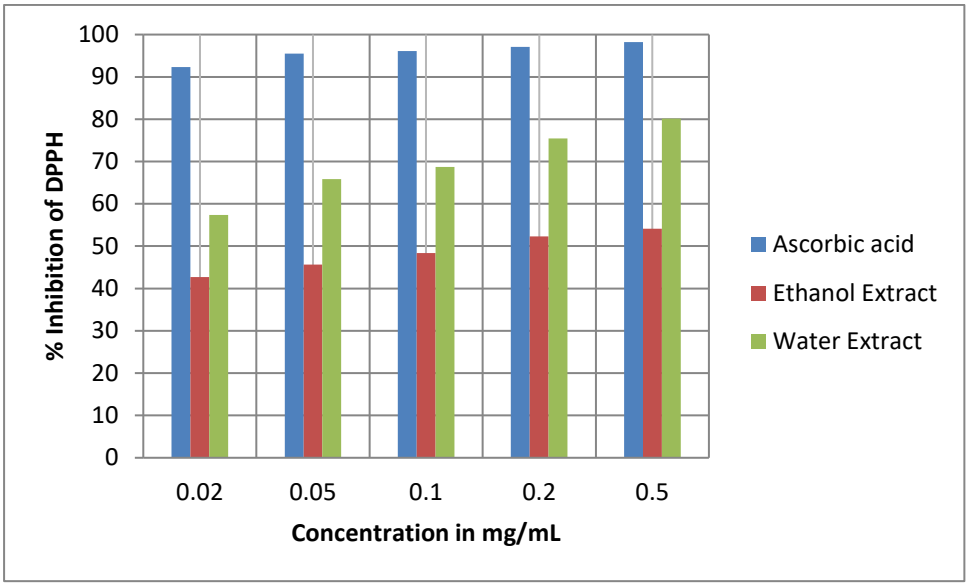
Table1: : Qualitative phytochemical Screening of Solanum nigrum

Phytochemical	Pet.Ether	Chloroform	Ethyl acetate	Ethanol	Water
Alkaloids	-	+	+	+	+
Flavonoids	-	+	+	+	+
Saponins	-	-	-	+	+
Tannins	+	+	+	+	+
Phenols		-	+	+	+
Amino Acids	-	-	-	-	-
Carbohydrate	-	-	-	-	-

The % inhibition of DPPH radical by S. nigrum extracts and standard indicated that the standard (ascorbic acid) was the most active on DPPH radicals (Fig. 1). Of all extracts, the water extract of the leaf showed the highest scavenging activity against DPPH radicals, its activity increased along concentration gradient (0.025-0.5 mg/ml), being highest (83.63%) at

0.5 mg/ml. The DPPH radical scavenging activity of the ethanol extract increased along concentration gradient and gave 54.11% inhibition at 0.5 mg/ml. Overall, the water extracts of the plant exhibited higher DPPH radical scavenging activity than the ethanol extracts.

Figure1: Antioxidant properties of S.nigrum



Conclusion:

The results of the present study showed that S. nigrum extracts contain biologically active ingredients such as alkaloids, flavonoids, glycosides, saponins, triterpenoids, and phenols which possess a wide array of pharmacological properties. S. nigrum extracts were found to be antioxidant in nature which is evident from DPPH scavenging assay. These findings suggest that S. nigrum can be used in the treatment of free radical mediated diseases and further investigation is recommended.

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