



RESEARCH ARTICLE

Comparative Evaluation of Phytochemical Constituents of Some Plants of Solanaceae Family

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<p>Manuscript details</p> <p>Submitted on 09.04.2015 Revised on 20.05.2015 Accepted on 26.06.2015 © CJPS All right reserved</p> <p>Columbia Journal of Pharmaceutical Sciences: 2015; 2 (2); April-June, Pages-11-15</p>	<p>ABSTRACT:</p> <p>The identification of primary and secondary constituents has become the most important tool to know the active principles of various medicinal plants. The present study was aimed at identification and evaluation of certain phytochemicals in <i>Withania somnifera</i>, <i>Solanum nigrum</i>, <i>Solanum indicum</i> and <i>Solanum xanthocarpum</i> of the family Solanaceae. The five different extracts namely petroleum ether, chloroform, ethanol, methanol and aqueous extracts of the whole plant used for identification of phytochemical constituents. The analysis revealed the presence of phytochemicals like alkaloids, flavonoids, saponins, steroids, tannins, proteins, glycosides, carbohydrates and phenolic compounds.</p>
<p>KEYWORDS:</p> <p><i>Withania somnifera</i>, <i>Solanum nigrum</i>, <i>Solanum indicum</i>, <i>Solanum xanthocarpum</i>, Quantitative analysis</p>	

1. INTRODUCTION:

Withania somnifera, *Solanum nigrum*, *Solanum indicum* and *Solanum xanthocarpum* belongs to the family Solanaceae. *Withania somnifera* is a well known as perennial herb in the Ayurveda and indigenous medical systems for 3000 years. *W. somnifera* is commonly known as Ashwagandha. Out of *Withania* genus three species are found in India namely, *W. somnifera*, *W. coagulans* and *W. Obtusifolia*, it is distributed in tropical and subtropical region like Rajasthan, Madhya Pradesh, Punjab, Himachal Pradesh, Jammu and Kashmir, Western Himalayas and Tamil Nadu.

The main active constituents are alkaloids and steroidal lactones. These include tropine and cuscohygrine. The leaves contain the steroidal lactones, withanolides, notably withaferin A, which was the first withanolides to be isolated from *W. Somnifera*¹. In Ayurveda, the berries

and leaves of *W. somnifera* are locally applied to tumors, tubercular glands, carbuncles, and ulcers. The roots of *W. somnifera* are used to prepare the herbal remedy. The plant is being exploited for preparation of over 200 formulations used in the treatment of various physiological disorders. *W. somnifera* is also used as a dietary supplement because it contains a variety of nutrients and photochemical.

The genus *Solanum* is comprised of about 1500 species and well represented all over the world. It is rich in alkaloids which are distributed in all parts of the plant². The active principles such as solinidine and other steroids extracted from the roots and leaves of some species are of potent and effective pharmaceuticals³. Majority of the *Solanum* species are widely used in folk medicine⁴. The presence of the steroidal alkaloid solasodine, an important starting material for the

synthesis of steroid hormones, is characteristic active principle of the genus *Solanum* L., which has tremendous impact on utilization of this genus economically and medicinally all over the world⁵⁻⁷. The lack of immediate known use for certain members of this group has led to their neglect and subsequent genetic erosion.

Solanum indicum Linn. belongs to the family Solanaceae commonly known as Byakur, Guta begun, Kata begun, Brihati, Indian Night shade etc. It is a bushy herb containing prickly spikes in the stem and available throughout the India and all over the tropical and subtropical regions of the world^{8,9}. The fruits are edible and traditionally used to treat various diseases. The different parts (fruits, leaves, roots) of this plant used by the traditional practitioners in the treatment of loss of appetite and anorexia, blood disorders, rhinitis, cough, asthma, sore throat and hiccup, sexual disorders, abdominal pain and worm infestation, pain and fever, inflammation, insomnia, urinary complications, cardiac weakness etc. It has been reported earlier, fruits and roots of this plant contains wax, fatty acids, alkaloid solanine and solanidine, disogenin, lanosterol, β -sitosterol, solasomnine, solamargine and solasidine etc^{8,9}. However, the medicinal properties have not been properly reported in previous studies. This led to the present team to investigate into the preliminary phytochemistry and pharmacological action of the crude methanolic extract (ME) of fruits of *Solanum indicum* Linn.

S. nigrum L. var *virginicum* (syn: *Solanum ptycanthum* Dunal ex DC) Solanaceae, is a fairly common herb or short-lived perennial shrub known as 'Black Nightshade'. It could grow up to 120 cm with the ovate to heart-shaped wavy leaves measuring about 75 cm long and 2-5 cm wide. The flowers have petals with greenish to whitish colour and surrounded by bright yellow anthers. The plants native to India and America but found in almost all parts of Africa¹⁰. Extracts of *S. nigrum* have shown anti-tumour and neuropharmacological properties as well as antioxidant and cancer chemo-protective matter^{11,12}. The leaves and seeds (berries) are used in Nigeria as vegetable in soup¹³. Besides being used for human consumption, the leaves serve as fodder and browse for domestic herbivorous animals. The plant is used for the treatment of boils and gonorrhoea but toxic to man. The berries especially when unripe were reported to contain poisonous solanocapsine and other alkaloids, that are fatal to man and animals^{14,15}. *S. nigrum* and its varieties have shown pharmacological properties^{16,17}. The phytochemical analysis of *S. nigrum* revealed that the plant have potential to reduce blood pressure while its saponins may prevent cancer¹⁸. The

plant contained an abundance of linoleic acid which gives the oil the nutritional and dietetic properties¹⁹.

S. xanthocarpum Schrad. and Wendl. is a perennial spiny under shrub commonly known as yellow-berried nightshade plant. In Tamil it is called kandankattiri. This plant is known for its medicinal benefits from time immemorial. The roots, stems, leaves, flowers and fruits of the plant are used in ayurvedic medicine^{20,21}. Different parts of the plant have been utilised traditionally for curing various ailments such as fever, cough, asthma and diabetes. The hot aqueous extract of dried fruits is used for treating cough, fever and heart diseases²². The plant is extensively studied for the various pharmacological activities like antiasthmatic, hepatoprotective, cardiovascular, hypoglycemic and antiulcer properties^{23,24}. Scientific evidence has been reported in favour of the traditional use of the fruits of *S. xanthocarpum* in the treatment of diabetes mellitus²⁵. The present investigation was aimed at evaluation of phytochemical constituents of the four valuable medicinal plants from family Solanaceae.

2. MATERIALS AND METHOD:

2.1 Plant collection and extract preparation

Material of four different plants *Withania somnifera*, *Solanum nigrum*, *Solanum indicum* and *Solanum xanthocarpum* free from disease were collected. The materials were washed thoroughly 2-3 times with running water and once with sterile distilled water then air-dried on sterile blotter under shade.

2.2 Successive solvent extraction

Thoroughly washed whole plant material of four plants of *Withania somnifera*, *Solanum nigrum*, *Solanum indicum* and *Solanum xanthocarpum* were dried in shade for five days and then powdered with the help of blender. Known quantities of shade dried powder filled in the Soxhlet apparatus for 18 hr using various solvent e.g. pet. ether, chloroform, methanol, ethanol and water and solvent was evaporated to dryness at constant temperature of 72 ° C at reduce pressure. The residues were weighed and stored at low temperature until use.

2.3 Preliminary Phytochemical studies

Preliminary phytochemical tests of various extracts of *Withania somnifera*, *Solanum nigrum*, *Solanum indicum* and *Solanum xanthocarpum* were performed for phytochemical analysis of alkaloids, glycosides, carbohydrates, steroids, polyphenol, saponins and terpenoids^{13,14}.

2.3.1 Test for alkaloids

(a) Dragendorff's test: To 1 ml of the extract, add 1 ml of dragendorff's reagent (Potassium Bismuth iodide solution). An orange-red precipitate indicates the presence of alkaloids.

- (b) Mayer's test: To 1 ml of the extract, add 1 ml of mayer's reagent (Potassium mercuric iodide solution). Whitish yellow or cream coloured precipitate indicates the presence of alkaloids.
- (c) Hager's test: To 1 ml of the extract, add 3ml of Hager's reagent (Saturated aqueous solution of picric acid), yellow coloured precipitate indicates the presence of alkaloids.
- (d) Wagner's test: To 1 ml of the extract, add 2 ml of wagner's reagent (Iodine in Potassium Iodide), Formation of reddish brown precipitate indicates the presence of alkaloids.
- (b) Fehling's test: To 1ml of the extract, add equal quantities of Fehling solution A and B, upon heating formation of a brick red precipitate indicates the presence of sugars
- (c) Benedict's test: To 5ml of Benedict's reagent, add 1ml of extract solution and boil for 2 minutes and cool. Formation of red precipitate shows the presence of sugars.

2.3.2 Test for saponins

Take small quantity of alcoholic and aqueous extract separately and add 20 ml of distilled water and shake in a graduated cylinder for 15 minutes lengthwise. A 1cm layer of foam indicates the presence of saponins.

2.3.3 Test for Glycosides

- (a) Legal test: Dissolve the extract in pyridine and add sodium nitroprusside solution to make it alkaline. The formation of pink red to red colour shows the presence of glycosides.
- (b) Baljet test: To 1ml of the test extract, add 1ml of sodium picrate solution and the yellow to orange colour reveals the presence of glycosides.
- (c) Keller-Killiani test: 1gm of powdered drug is extracted with 10ml of 70% alcohol for 2 minutes, filtered, add to the filtrate, 10ml of water and 0.5ml of strong solution of lead acetate and filtered and the filtrate is shaken with 5ml of chloroform. The chloroform layer is separated in a porcelain dish and removes the solvent by gentle evaporation. Dissolve the cooled residue in 3ml of glacial acetic acid containing 2 drops of 5% ferric chloride solution. Carefully transfer this solution to the surface of 2ml of concentrated sulphuric acid. A reddish brown layer forms at the junction of the two liquids and the upper layer slowly becomes bluish green, darkening with standing.
- (d) Borntrager's test: Add a few ml of dilute Sulphuric acid to 1ml of the extract solution. Boil, filter and extract the filtrate with chloroform. The chloroform layer was treated with 1ml of ammonia. The formation of red colour of the ammonical layer shows the presence of anthraquinone glycosides.

2.3.4 Test for carbohydrates and sugars

- (a) Molisch's test: To 2ml of the extract, add 1ml of α -naphthol solution, add concentrated sulphuric acid through the side of the test tube. Purple or reddish violet colour at the junction of the two liquids reveals the presence of Carbohydrates.

2.3.5 Test for tannins and phenolic compounds

- (a) Take the little quantity of test solution and mixed with basic lead acetate solution. Formation of white precipitates indicates the presence of tannins.
- (b) To 1ml of the extract, add ferric chloride solution, formation of a dark blue or greenish black colour product shows the presence of tannins.
- (c) The little quantity of test extract is treated with Potassium ferric cyanide and ammonia solution. A deep red colour indicates the presence of tannins.

2.3.6 Test for flavonoids

- (a) The drug in alcoholic and aqueous solution with few ml of ammonia is seen in U.V. and visible light, formation of fluorescence indicates the presence of flavonoids.
- (b) Little quantity of extract is treated with amyl alcohol, sodium acetate and ferric chloride. A yellow colour solution formed, disappears on addition of an acid indicates the presence of flavonoids.
- (c) Shinoda's test: The alcoholic extract of powder treated with magnesium foil and concentrated HCl give intense cherry red colour indicates the presence of flavonones or orange red colour indicates the presence of flavonols.
- (d) The extract is treated with sodium hydroxide, formation of yellow colour indicates the presence of flavones.
- (e) The extract is treated with concentrated H_2SO_4 , formation of yellow or orange colour indicates flavones.

2.3.7 Test for steroids

- (a) Libermann-Burchard test: 1gm of the test substance was dissolved in a few drops of chloroform, 3ml of acetic anhydride, 3ml of glacial acetic acid were added, warmed and cooled under the tap and drops of concentrated sulphuric acid were added along the sides of the test tube. Appearance of bluish-green colour shows the presence of sterols.
- (b) Salkowski test: Dissolve the extract in chloroform and add equal volume of conc. H_2SO_4 . Formation of bluish red to cherry colour in chloroform layer and green fluorescence in the acid layer represents the steroidal components in the tested extract.

2.3.8 Test for triterpenoids

Noller's test: Dissolve two or three granules or tin metal in 2ml thionyl chloride solution. Then add 1ml of the extract into test tube and warm, the formation of pink colour indicates the presence of triterpenoids.

3. RESULTS AND DISCUSSIONS:

Table 1 shows the result of successive extracts in different solvents of whole plant materials of solanaceae family plants. *Withania somnifera* shows the presence of phytosterols, phenols, tannins and protein and absence of cardiac glycosides, saponins, flavanoids and carbohydrates in Pet. ether extract and *Solanum nigrum* and *Solanum indicum* demonstrated the presence of only cardiac glycoside and absence of alkaloids, flavanoids, phenols, saponins, cardiac glycosides, phytosterols, tannins, proteins and carbohydrates in pet ether extract.

Solanum xanthocarpum also shows the presence of only cardiac glycosides, in Pet Ether Extract. The Comparative data of successive plant extract of all species shows in Table 1. The ethanolic and aqueous extract shows maximum constituents as compared to other solvents.

The result indicates that qualitative chemical analysis was useful preliminary phytochemical characterization of the solanaceae family plants which have the more bioactive compound. The result of *Withania somnifera*, *Solanum nigrum*, *Solanum indicum* and *Solanum xanthocarpum* compounds are known to have curative activity against diseases producing pathogen. Therefore it could be used pharmacologically to develop new compounds for health benefit.

Table 1: Phytochemical screening of various extracts of Solanaceae family

Extracts	CG	S	PS	Ph	F	A	T	P	Ca
<i>Withania somnifera</i>									
Pet Ether	-	-	+	+	-	+	+	+	-
Chloroform	-	-	+	-	-	+	-	+	-
Methanol	-	-	+	-	-	-	-	-	-
Ethanol	-	+	-	-	+	+	-	-	-
Water	-	+	+	-	-	+	-	-	-
<i>Solanum nigrum</i>									
Pet Ether	+	-	-	-	-	-	-	-	-
Chloroform	-	-	-	-	-	+	-	-	-
Methanol	-	+	-	+	+	+	-	-	-
Ethanol	-	-	+	-	+	-	-	+	-
Water	-	+	+	-	-	+	-	-	-
<i>Solanum xanthocarpum</i>									
Pet Ether	+	-	-	-	-	-	-	-	-
Chloroform	+	-	-	-	-	-	-	-	-
Methanol	-	+	-	+	+	+	+	-	-
Ethanol	-	-	+	-	+	-	-	-	-
Water	-	+	+	-	+	-	-	-	-
<i>Solanum indicum</i>									
Pet Ether	+	-	-	-	-	-	-	-	-
Chloroform	-	-	-	-	-	+	-	-	-
Methanol	-	+	-	+	+	+	-	-	-
Ethanol	-	-	+	-	+	-	-	+	-
Water	-	+	+	-	-	+	-	-	-

Cardiac glycoside – CG, alkaloids – A, flavonoids - F, Phenols - Ph, Saponins - S, phytosterols - PS, tannins - T, proteins – P, carbohydrates – Ca

4. CONCLUSIONS:

The successively extracts of studied plants showed the presence of bioactive compounds in all the four plants. The ethanolic and aqueous extracts of all plants showed the presence of maximum bioactive compounds in all the four species. Thus these plant species pharmacologically more important for treatment of various diseases.

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