Bioprofiling of phytochemicals and phytonutritional potentials of *Solanum incanum* L.

Kaliyamoorthy Kumar¹, Darwin Christdhas Henry² and Kathiresan Sivakumar¹,*

¹Department of Botany, Faculty of Science, Annamalai University, Annamalai Nagar – 608 002, Chidambaram, Tamil Nadu, India
²Department of Plant Pathology, Faculty of Agriculture, Annamalai University, Annamalai Nagar – 608 002, Chidambaram, Tamil Nadu, India

*E-mail address: kshivam69@gmail.com

ABSTRACT

In recent decades, a lot of interest in pharmaceutical industries to focus on ‘Phytochemicals’ and healthcare sectors to concentrate ‘Phytomunrients’ derived from natural products of plant origin. *Solanum incanum* L. is a roadside weed shrub and its ripened berries were treating various ailments. In the current decade, an attempted have been made for screening of Phytochemical and Phytonutrients values. Its leaves, stem, root and fruits of ethanolic extract were evaluated. In percent phytochemical *Solanum incanum* contains alkaloids, flavonoids, saponins, phenols, steroids and triterpenoids. The maximum amount of Phytochemicals and Phytonutrients (Na, Al, Mg, Mn, P, Cl, K, Ca, Fe, Cu and Zn) was recorded in fruit when compared with leaves, stem and root. They were analyze for their basic proximate composition, Vitamin, mineral elemental compositions and phytochemical profile to the results of this study suggested that, Plants play with altering environmental conditions to acclimatize to these changes of its archetypes variations. This adaptation is accompanied by an unusual phytochemical diversity, especially for Phytochemicals and Phytonutrients.

**Keywords:** Phytochemicals, Phytomineral, Proximate composition, Vitamins, *Solanum incanum*, *Solanum panduriforme*, *Solanum bojeri*
1. INTRODUCTION

India has immense wealth of biodiversity concisely, its having 10 biogeographical regions and also it is renowned as one the world’s top 12 mega biodiversity nations. In this view of the considerations, biodiversity is for chemical diversity and reliable phytochemical sources for the discovery of new drugs. Therefore, recent years the growing clinical demands on motivating the biomedical technology to searching for the new therapeutic compound depends upon the biodiversity of the nations. Over 70% of new valuable chemical substance (New Chemical Entities - NCEs) introduced into remedial practice to test the quality of the product and also they can play a vital role in drug development of Pharmaceutical industry were derived from natural products from plant origins. Solanum incanum L. (Family – Solanaceae) Synonyms: Solanum panduriforme E. Mey. Solanum bojeri Dunal. Vernacular Name is Mullakathirikkai, with Common name is Indian nightshade, thorn apple, bitter apple, bitter ball and bitter tomato. It is a nightshade family that is native to sub – Saharan Africa and grown in many regions of Far East Asia, Africa, and Middle eastwards to India.

The Plant is an erect or spreading perennial shrub small prickle in leaves and stems. They creepy in nature, leaves are arranged in alternate, usually simple and lack stipules. In nature, the flowers are actinomorphic of only slightly zycomorphic. The young green and ripened fruits are yellow coloured. It is found that effective in treating various ailments such as, throat like a sore throat, angina, stomachache, painful menstruation, liver pain, pneumonia and rheumatism and it is having antimicrobial and anti-tumor activities. For these purposes, leaf, root and fruit decoctions are drunk, roots are chewed and sap swallowed, leaf sap is used for washing painful areas, and ash of burnt plants is mixed with fat and applied externally.

In the present investigation, we are concluding that a screening of phytochemicals (Alkaloids, Flavanoids, Saponins, Phenols, Phytosterols with anodes, Glycosides, Triterpenoids, Tannins, Anthaquinones, Carbohydrates and steroids) and Phytonutrients constituents (Na, Al, Mg, Mn, P, Cl, K, CA, Fe, Cu and Zn) from Solanum incanum plant root, stem, leaves and fruits by Scanning Electron Micrographic with Energy Dispersive Spectroscopic analysis were made (SEM-EDS).

2. MATERIALS AND METHODS

2. 1. Source of Plant collections

The Plants were collected in Southern Western Ghats Ecoregions of the Nilgiri Biosphere Reserve. In India consists of 18 Biosphere Reserve, the Nilgiri biosphere Reserve is a chain of hills and one of the most floristically richest areas in India, established under the MAB Program by UNESCO in 1986. The tracts chosen was at once large enough to form a biosphere reserve with biologically valuable phytogeographical unit and small enough to be Nilgiri regions. This region consists of many exotic species, of which 2700 species are flowering plants (District of Nilgiri 2018). The frequent field visits were made to collect from dense forest continues to be forested tracts at edges and in bush land and grassland, from sea-level up to 2500 m altitude viz., Cherangode (Panthalur), Muthumalai (Gudalur), Masinagudi (Ooty), Jagathala (Godhagiri) and Wellington (Coonoor). It lies between Latitude: 11°0’ to 11°37’ N and longitude: 76° 27, E to 77°4E with the total regions of 2,479 square kilometers and there are ranging between 750m and 2580m above Mean Sea Level, it is an important region in the
overall biodiversity ranking in South Asia. It is situated in the north western corner of Tamil Nadu, are bounded on the north by the Mysore district of Karnataka, on the west and south west by wyanad district of Kerala on the east by Erode district and south of Coimbatore district of Tamil Nadu states. During summer, the temperature is around 21 to 25 degrees of Celsius. Likewise, winter the region has an average rainfall around 1,960 mm. The collections were accompanied by comprehensive field information (Fig. 1).

![Fig. 1. Solanum incanum L. flowering details.](image)

2. 2. Identification and authentication of plant materials

A survey was carried out during December, 2018 to March, 2019, than herbarium specimens prepared, the plant species were primarily identified and got a specimen accession number and herbarium voucher specimen (ACC No. BOT 242) was deposited at Department of Botany, Annamalai University, Annamalai Nagar, Tamil Nadu. Further, identified and authenticated by Dr. G.V.S Murthy, Scientist ‘F’ & Head of Office, Botanical Survey of India.
2. 3. Phytochemical screening of *Solanum incanum* L.

Phytochemical Studies on plant based secondary metabolites have been increasing over the last 50 years. However, plants having suitable alternative, clinically useful therapeutic compounds for low cost production of high quality much safer and biologically active. Present phytochemical examinations were carried out for as per the standard methods.

2. 3. 1. Sample preparation

The fresh samples powder was prepared in our phytochemical laboratory. The unripe fruits were detached from the stalk and thoroughly washed with distilled water. Then, it is dried out in the hot air oven at 60 °C and left overnight. The dried sample was blended into powder and stored in a sample container. Otherwise, the shade dried plant material is powdered using mixer grinder, and subjected to Soxhlet extraction apparatus with ethanol for 18h in the order of increasing polarity of solvents. The condensed extracts were used for preliminary screening of photochemical.

2. 3. 2. Detection of Alkaloids

Extracts were dissolved individually in dilute H₂SO₄ and filtered.

a) **Mayer’s Test**: Filtrates were treated with Mayer’s reagent (Potassium Mercuric Iodide). Formation of a yellow coloured precipitate indicates the presence of alkaloids.

b) **Wagner’s Test**: Filtrates were treated with Wagner’s reagent (Iodine in Potassium Iodide). The formation of a brown/reddish precipitate indicates the presence of alkaloids.

c) **Dragendorff’s Test**: Filtrates were treated with Dragendorff’s reagent (Solution of Potassium Bismuth Iodide). Formation of a red precipitate indicates the presence of alkaloids.

d) **Hager’s Test**: Filtrates were treated with Hager’s reagent (Saturated picric acid solution). Presence of alkaloids confirmed by the formation of a yellow coloured precipitate.

2. 3. 3. Detection of Carbohydrates

Extracts were dissolved individually in 5 ml distilled water and filtered. The filtrates were used to test for the presence of carbohydrates.

a) **Molisch’s Test**: Filtrates were treated with 2 drops of alcoholic α-naphthol solution in a test tube. Formation of the violet ring at the junction indicates the presence of Carbohydrates.

b) **Benedict’s Test**: Filtrates were treated with Benedict’s reagent and heated gently. Orange red precipitate indicates the presence of reducing sugars.

c) **Fehling’s Test**: Filtrates were hydrolysed with Dil. HCl, neutralized with alkali and heated with Fehling’s A & B solution. Formation of a red precipitate indicates the presence of reducing sugars.
2. 3. 4. Detection of Glycosides

Extracts were hydrolysed with Dil. HCl, and then subjected to test for glycosides.

a) **Modified Borntrager’s Test:** Extracts were treated with a Ferric Chloride solution and immersed in boiling water for about 5 minutes. The mixture was cooled and extracted with equal volumes of benzene. The benzene layer was separated and treated with ammonia solution. Formation of rose-pink colour in the ammonical layer indicates the presence of anthranol glycosides.

b) **Legal’s Test:** Extracts were treated with sodium nitropruside in pyridine and sodium hydroxide. Formation of pink to blood red colour indicates the presence of cardiac glycosides.

2. 3. 5. Detection of Saponins

a) **Froth Test:** Extracts were diluted with distilled water to 20ml and this was shaken in a graduated cylinder for 15 minutes. A formation of 1 cm layer of foam indicates the presence of saponins.

b) **Foam Test:** 0.5 g of the extract was shaken with 2 ml of water. If foam produced persists for ten minutes it indicates the presence of saponins.

2. 3. 6. Detection of Phytoestersols

a) **Salkowski’s Test:** Extracts were treated with chloroform and filtered. The filtrates were treated with a few drops of Conc. Sulphuric acid, shaken and allowed to stand. Appearance of golden yellow colour indicates the presence of triterpenes.

b) **Libermann Burchard’s Test:** Extracts were treated with chloroform and filtered. The filtrates were treated with a few drops of acetic anhydride, boiled and cooled. Conc. Sulphuric acid was added. The formation of brown ring at the junction indicates the presence of phytosterols.

2. 3. 7. Detection of Phenols

a) **Ferric Chloride Test:** Extracts were treated with 3-4 drops of ferric chloride solution. Formation of bluish black colour indicates the presence of phenols.

2. 3. 8. Detection of Tannins

a) **Gelatin Test:** To the extract, 1% gelatin solution containing sodium chloride was added. Formation of white precipitate indicates the presence of tannins.

2. 3. 9. Detection of Flavonoids

a) **Alkaline Reagent Test:** Extracts were treated with a few drops of sodium hydroxide solution. Formation of intense yellow colour, which becomes colourless on addition of dilute acid, indicates the presence of flavonoids.

b) **Lead Acetate Test:** Extracts were treated with a few drops of lead acetate solution. Formation of a yellow colour precipitate indicates the presence of flavonoids.
2. 3. 10. Detection of Proteins and Amino acids

a) **Xanthoproteic Test:** The extracts were treated with a few drops of conc. Nitric acid. Formation of yellow colour indicates the presence of proteins.

b) **Ninhydrin Test:** To the extract, 0.25% w/v ninhydrin reagent was added and boiled for a few minutes. Formation of blue colour indicates the presence of amino acid.

2. 3. 11. Detection of Diterpenes

a) **Copper acetate Test:** Extracts were dissolved in water and treated with 3-4 drops of copper acetate solution. Formation of emerald green colour indicates the presence of diterpenes.

3. NUTRITIONAL AND MINERAL COMPOSITION

3. 1. Sample preparation

The prepared powder powder was oven dried at 60 °C for 1 h, and then the samples are powered well grained an agate mortar. The powered samples were observed using Scanning Electron Microscope with EDS and EBSD (JSM – 6610LV) made Jeol India Pvt. Ltd., with an acceleration voltage of 20 kv. Earlier than the study, the collected powder was accumulated on aluminium stumps and coated with gold in a supporting device under vacuum. The structural morphology of prepared powder is stem like with spherical structure confirmed by Scanning electron micrograph, and elemental compositional features such as Phytonutrients constituents (Na, Al, Mg, Mn, P, Cl, K, Ca, Fe, Cu and Zn) from *Solanum incanum* root, stem, leaves and fruits confirmed by Energy Dispersive spectroscopic analysis. The occurrence of gold coated specify that stability of the samples

3. 2. Proximate Analysis

Total Carbohydrates, Total Ash, Crude Fiber, Crude Fat, Protein and Moisture Content were determined using standard methods.

3. 2. 1. Moisture Content Determination

About 2 g of the fresh sample was transferred to a previously dried and weighed crucible. The crucible was placed into an oven and the sample dried for 5 hours at 105 °C. The sample was then cooled in desiccators and then weighed. The moisture content is expressed in weight percentage by measuring the weight loss after drying.

3. 2. 2. Crude Fat Determination

About 2 g of the sample was transferred into a Whatman paper and sealed. 150 ml of petroleum ether was poured into previously dried and weighed round bottom flask. The sample was then placed into the Soxhlet extractor and the condenser connected to it. The setup was assembled and the flask placed into the heating mantle. The sample was then refluxed for 4 hours. After the extraction, the thimble was removed and the solvent recovered. The fat that was obtained was then dried together with the flask in an oven for 30 minutes at 105 °C. It was then cooled in desiccators and weighed.
3. 2. 3. Protein Determination

About 2 g of the sample was put into a digestion flask and heated with 25 ml of concentrated H\textsubscript{2}SO\textsubscript{4} in the presence of selenium catalyst. The sample was digested using a digestion burner till a clear solution was obtained. The digested sample was then transferred into a 100 ml volumetric flask and topped to the mark. 25 ml boric acid was measured into a 250 ml conical flask and two drops of mixed indicator was added. The apparatus was flushed with boiling distilled water and then the liquid was drained from the steam trap before use. The conical flask and its contents were then placed under pressure in such a way that the tip was completely immersed in the solution. 10 ml of the digested sample solution was poured into the steam jacket through a funnel and then 15 ml of 40% NaOH was then added to the decomposition flask. The funnel stopcock was closed to drive the liberated ammonia into the collection flask. Steam was forced through the decomposition chamber by shutting the stopcock on the steam trap outlet. The boric acid changed to bluish green as soon as it came into contact with the ammonia. The conical flask was then removed after 5 minutes. The content of the flask was titrated against 0.1 N HCl until the solution became colorless. This was done in triplicate. A blank titration was done to correct for traces of nitrogen in the reagents.

3. 2. 4. Crude Fiber Determination

The sample of the filter paper used for the fat determination was transferred into a 750 ml Erlenmeyer flask and 0.5 g of asbestos was added. 200 ml of boiling 1.25% H\textsubscript{2}SO\textsubscript{4} was added immediately and the flask was set on a hot plate and the condenser was connected. After 30 minutes the flask was removed and its contents were immediately filtered through a clean linen cloth. The sample was then washed repeatedly with a large volume of water until the washings were no longer acidic. 200 ml of 1.25% of boiling NaOH was added to the filtrate. It was also boiled for 30 minutes and washed several times until it was no longer basic. The residue was then transferred into a weighed crucible. The crucible and its content were dried and ashed for 30 minutes. The crucible was then cooled and weighed. The percentage crude fiber was expressed as weight loss in percentage.

3. 2. 5. Total Ash Determination

About 2 g of the sample was measured into a previously weighed crucible. The crucible together with the sample was put in a furnace (600 °C) for 2 hours. The crucible was then removed and cooled. The total ash was expressed as a percentage of the initial weight.

3. 2. 6. Total Carbohydrate Determination

The total carbohydrate content of the sample was obtained by taking the difference between 100 and the sum of the moisture, crude fiber, protein, fat and ash contents in the sample.

3. 2. 7. Determination of Vitamin A (β-Carotene)

The unripe fruits were well washed with tap water and blended with a little amount of water. This was then sieved and transferred into a clean bottle to be stored. About 10 ml of the sample was measured and poured into a mortar. A spatula full of anhydrous sodium sulphate was added to remove the water in the sample. 45 ml of acetone was added in bits to the sample...
while grinding. The mixture was filtered. The filtrate was transferred into a separating funnel containing 20 ml of petroleum spirit and then washed with water by using a wash bottle to wash the sides of the funnel. This was repeated until the aqueous layer was no longer turbid. The organic layer was filtered by placing a few grams of anhydrous sodium sulphate on the filter paper. 2 ml of the organic layer was measured in a small test tube. Nitrogen gas was used to evaporate the sample to dryness and then it was reconstituted with 700 μl of methanol dichloromethane (50:50) 20 μl of the sample was then injected into a Shimadzu HPLC with an ODS C18 column and a mobile phase of acetonitrile, dichloromethane and methanol (70:20:10) in isocratic mode. Analyse was monitored at 452 nm.

3. 2. 8. Determination of Vitamin C

A juice of the sample was made by using about 50 g of the fruits and 200 ml of water by blending and sieving. 5 ml of metaphosphoric acid/acetic acid and 2 ml of the juice were measured into an Erlenmeyer flask and the solution was titrated against indophenol dye.

4. STATISTICAL ANALYSIS

All the experiments were performed in triplicate (n = 3) and results were expressed as mean ± SD. Statistical measurements were performed with (SPSS Inc., Chicago, IL, USA. Package version 16.0 Statistical Software) Using ANOVA, two way method followed By Duncan’s Test (P < 0.05) was measured statistically significant and Bar diagram was drawn By Origin statistical Software version 6.0 and Microsoft Excel statistical analysis package.

5. RESULTS

*Solanum incanum* leaves, stem, root and fruits of ethanol extract was evaluated for its Phytonutrients and Phytochemical value using standard analytical methods. In phytochemical analysis *Solanum incanum* contains all the phytochemical (Table 1) like alkaloids, flavonoids, saponins, phenols, steroids and triterpenoids the maximum amount of phytochemicals were recorded in fruit when compare with leaves, stem and root sample. Phytonutritional analysis shows the mineral composition (Fig. 2 and Table 2) revealed that *S. incanum* Fruits Contain 27.43% of Sodium (Na) when compare with leaves (8.81%) stem and root is not detected. Phosphorus content is higher in fruit 42.39% when compared with leaves (0.78%) root and stem not detected. The potassium content is higher in leaves (14.23%) when compared to fruits (0.05%); Calcium content is higher in root 18.35% when compared with leaves 11.49% root (7.72%) fruits is not detected. Chromium content is higher in stem (13.33%) when compared to leaves (10.43%) root and fruits not detected. Manganese is higher (11.62%) when compared with stem (7.49%), fruits (2.19%), and root 0.080%; Nickel was higher in root (27.41%) when compare with leaves (04.51%), stem 3.47% and root detected. Copper contain higher in leaves (34.60%) when compared with stem (31.03%) roots and fruits are not detected. Zinc contains higher in stem (31.10%), when compared with fruits (13.64%); leaves (3.53%) root not detected. Iron content was higher in root (33.91%) when compare with fruits (7.32%) stem (5.86%) leaves not detected. Magnesium content is higher in roots (4.79%) when compared with fruits (4.79%) when compared with fruits (4.49%) leaves and stem not detected. Selenium
content higher in roots (14.75%) when compared with fruits 1.88%, leaves and stem not detected. The results of mineral composition revealed that *S. incanum* fruits constitute a good source essential mineral detected in the eggplants that play very indispensable role in normal human metabolism.

**Table 1.** The Phytochemical screening of ethonolic extract of *Solanum incanum* L.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Test</th>
<th>Reagents</th>
<th>Ethanolic Extract Plant parts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Leaves</td>
</tr>
<tr>
<td>1.</td>
<td>Alkaloids</td>
<td>Mayer’s Test</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dradvndroff’s Test</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wagner’s test</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hager</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>Flavanoids</td>
<td>Shinoda test</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mg Turning test</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alkaline reagent test</td>
<td>+</td>
</tr>
<tr>
<td>3.</td>
<td>Saponins</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>4.</td>
<td>Phenols</td>
<td>Ferric chloride test</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lead acetate test</td>
<td>-</td>
</tr>
<tr>
<td>5.</td>
<td>Polyphenols</td>
<td>Salkowski test</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td>Phytosterols / with anoids</td>
<td>Libermann Buchard test</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Salkowski test</td>
<td>-</td>
</tr>
<tr>
<td>7.</td>
<td>Glycosides (Oligosaccharides)</td>
<td>Modified Borntrager’s test</td>
<td>-</td>
</tr>
<tr>
<td>8.</td>
<td>Triterpenoid</td>
<td>Libermann Buchard test</td>
<td>++</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Salkowski test</td>
<td>-</td>
</tr>
<tr>
<td>9.</td>
<td>Tannins</td>
<td>Ferric Chloride test</td>
<td>++</td>
</tr>
<tr>
<td>10.</td>
<td>Anthaquinones</td>
<td>Borntrager’s test</td>
<td>-</td>
</tr>
<tr>
<td>11.</td>
<td>Carbohydrates</td>
<td>Molisch’s test</td>
<td>-</td>
</tr>
<tr>
<td>12.</td>
<td>Steroids</td>
<td>10 ml CHCl₃ and 10 ml of Conc. H₂SO₄</td>
<td>+</td>
</tr>
</tbody>
</table>

(+ Sign indicates Positive result; ++ Sign indicates strongly positive result; – Sign indicates negative result)
Table 2. Mineral elemental composition of *Solanum incanum* L.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Mineral Compositions</th>
<th>Symbols</th>
<th>Presence of elemental compositions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Leaves</td>
</tr>
<tr>
<td>1</td>
<td>Sodium</td>
<td>Na</td>
<td>8.81</td>
</tr>
<tr>
<td>2</td>
<td>Phosphorus</td>
<td>P</td>
<td>0.78</td>
</tr>
<tr>
<td>3</td>
<td>Pottassium</td>
<td>K</td>
<td>14.23</td>
</tr>
<tr>
<td>4</td>
<td>Calcium</td>
<td>Ca</td>
<td>11.49</td>
</tr>
<tr>
<td>5</td>
<td>Chromium</td>
<td>Cr</td>
<td>10.43</td>
</tr>
<tr>
<td>6</td>
<td>Manganese</td>
<td>Mn</td>
<td>11.62</td>
</tr>
<tr>
<td>7</td>
<td>Nickel</td>
<td>Ni</td>
<td>04.51</td>
</tr>
<tr>
<td>8</td>
<td>Copper</td>
<td>Cu</td>
<td>34.60</td>
</tr>
<tr>
<td>9</td>
<td>Zinc</td>
<td>Zn</td>
<td>3.53</td>
</tr>
<tr>
<td>10</td>
<td>Iron</td>
<td>Fe</td>
<td>ND</td>
</tr>
<tr>
<td>11</td>
<td>Magnesium</td>
<td>Mg</td>
<td>ND</td>
</tr>
<tr>
<td>12</td>
<td>Selenium</td>
<td>Se</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td><strong>ND – Not Detected</strong></td>
<td></td>
<td></td>
</tr>
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Table 3. Mineral elemental composition of *Solanum incanum* L.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Percentage of proximate composition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leaves</td>
</tr>
<tr>
<td>Moisture</td>
<td>96.76</td>
</tr>
<tr>
<td>Ash</td>
<td>21.01</td>
</tr>
<tr>
<td>Protein</td>
<td>8.05</td>
</tr>
<tr>
<td>Fat</td>
<td>12.25</td>
</tr>
<tr>
<td>Crude Fibre</td>
<td>5.79</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>56.75</td>
</tr>
</tbody>
</table>

P Value -0.001
Fig. 2. Mineral elemental compositions of *Solanum incanum* L

Fig. 3. Proximate composition of *Solanum incanum* L.
Proximate composition (Fig. 3) was carried out the moisture content of fruits is higher (98.72%) when compared with values leaves (96.76%) stem (75.45%) and root (65.24%); the higher ash value was found in fruits (21.15%) when compared with leaves (20.01%); stem (21.14%) and root (20.10%); the higher amount of protein content where found in fruits (8.20%) when compare with leaves (8.05%); stem (7.75%) and root (6.86%). The higher fat content found in fruits (12.50%) when compared with leaves (12.25%); stem (10.18%) lowest value was found in the root (10.18%) crude fibre were higher value was found in fruits (6.55%) when compare with leaves (5.79%), root (4.75%) and lower value found in stem (4.56%); carbohydrate is higher in fruits (60.05%) when compare with leaves (55.75%), root (55.25%) and stem (55.05%). All the consequences were statistically analysis the P – value is 0.001 the proximate composition value of significance (Table 3)

Figure 4 and Table 4 shows the results of the vitamin composition of Solanum incanum. The Vit-C content was higher in fruits (2.966%) when compared with the root (2.782%); leaves (2.769%) and stem (2.682%). The Pro- Vitamin-A were higher in fruits (0.075%), when compare with leaves (0.073%) root (0.062%) and stem (0.051%) were recorded. All the outcome were proved statistically significance the P – value is 0.001.

<table>
<thead>
<tr>
<th>Vitamins</th>
<th>Percentage of Proximate composition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leaves</td>
</tr>
<tr>
<td>Vit - C</td>
<td>2.769</td>
</tr>
<tr>
<td>Pro Vit - A</td>
<td>0.073</td>
</tr>
</tbody>
</table>

P Value - 0.001
Fig. 5. EDS Spectrum in *S. incanum* leaves

Fig. 6. EDS Spectrum in *S. incanum* stem
Fig. 7. EDS Spectrum in *S. incanum* root

Fig. 8. EDS Spectrum in *S. incanum* fruits
Fig. 9. SEM *Solanum incanum* leaves

Fig. 10. SEM *Solanum incanum* stem
Fig. 11. SEM Solanum incaenum root

Fig. 12. SEM Solanum incaenum fruits
6. DISCUSSION

The consequences of the quantitative results performs bioactive constituents of *S. incanum* leaves, stem, root, and fruits are well sources of bioactive phytochemical which include alkaloids, flavonoids, tannins, saponins, triterpenoids, Polyphenols, Phytosterols, Glycosides, Steroids, Anthaquinones and phenols. A similar report was made. Who noted the occurrence of alkaloids, saponins, tannins and flavonoids in the leaves of *S. myricanthus* and *S. nigrum*. Reported the presence of cardiac glycosides in *S. aethiopicum* and *S. microcapon* but noted absence of steroids in *S. macrocarpon* fruits which is contrary to the results obtained. Similarly, phytochemical screening of *S. macrocapon* fruits revealed that the presence of flavonoids, triterpenoids and steroids. Hence, most of the observed achieve of *S. incanum* fruits sample may be due to its wealth in bioactive phytochemical constituents. The tannins found in this eggplant was observed which revealed moderate amount of tannins in the fruits of *S. myricanthus* and *S. macrocarpon* in Nigeria. The bitter flavor of *S. incanum* as presence of tannins in the fruits. The combination of glycoalkaloids and saponins reported to protect plants from the attack of many fungi, yeasts, bacteria and viruses. Tannins are known to possess antioxidant and antibacterial, as well as anti-inflammatory properties. The occurrence of tannins in *S. incanum* fruits are physiological responsibility in treating wounds. The fruits of *S. incanum* also contained phenols and they have been shown to acquire antibacterial, antiviral, antimutagenic and anticarcinogenic properties.

Apart from the phenols, other phytochemicals detected to contain steroids and triterpenoids. Have reported. The positive results of steroids of the fruits do not come from the same geographical areas and growing conditions are different from the report. Steroids regulate carbohydrate and protein metabolism, and possess anti-inflammatory properties. Furthermore, terpenoids and steroids are known to acquire antibacterial and antineoplastic properties. Terpenoids have anti-hepatoxic properties, thus helping to prevent liver damage. This study verified the presence of phytochemical constituents in *S. incanum* leaves, stem, root and fruits which could partly explain the use of the plant for the treatment of various diseases as claimed by various researchers. The fruits of *Solanum incanum* possess very high moisture content (98.72%) as depicted in Fig 1. For the other parameters. The proximate composition of *S. incanum* roots showed low moisture content (65.24%).

The moisture content was lower than those reported in *S. gilo*, *S. aethiopicum* and *S. anguivi*. Low moisture content hampers the growth of microorganism and promote longer shelf-life. The results obtained indicated that carbohydrates 8.05%, proteins 2.20%, fats 0.25%, the similar value was obtained from the leaves (0.25%), ash 0.15% and higher crude fiber content (3.75%) were obtained from the roots of this plant. In a similar study conducted proximate composition analysis revealed a lower moisture percentage (80.5 %) but the much higher ash content (12.3 %). (9) The value for ash in the eggplant fruits was 8.89 0.02% and was higher than 0.87 0.03% and 0.47 0.02% respectively for *S. aethiopicum* and *S. macrocarpon*. The obtained result compared for *S. gilo* (9.75%) and *S. anguivi* (7.60%) Ash content is a reflect that the fruits are rich in mineral elements. The estimated value (2.20%) for crude protein in *S. incanum* fruits were fairly superior than the reported values for some *Solanum* sp.

This result illustrates that the investigate eggplant fruits are a good source of protein and can meet the suggested for daily necessities for human. The *S. incanum* root contained 3.75% crude fiber, which can be compared well with 2.79% reported for *Solanum* sp. The result established that the vegetable can be ranked as fiber, rich vegetable. Vegetables that are rich in
dietary fiber are usually employed in the biomedical treatment such as obesity, diabetes, cancer and abdominal disorder. This result differs from the work of who reported absence of Copper and Manganese in S. gilo, S. aethiopicum and S. anguivi fruits. In addition, Selenium, Nickel and Chromium were significance value was detected in this study. The bioactive phytochemicals and mineral elemental constituents has justified its medicinal uses of the plant. It has also unveiled its potentials for nutritional supplements in our daily food intake and also these evidences are the future pathway for the development of various formularies and their scientific data revealed new drug discovery in global health complications.

7. CONCLUSIONS

They were analyzed for their basic composition of mineral to the results of this study suggested that, Plant interact with changing their surroundings and adapt to these changes of its ecotypes variations. This variation is accompanied by an unusual phytochemical diversity, especially for Phytochemical and Phytonutrients. Consequently, there is need to encourage the consumption and cultivation of this uncommon eggplants. The bioprofiling of Solanum incanum the preliminary phytochemical has yielded encouraging results for further comprehensive investigation into many life saving drugs. Phytochemical tests with various colouring reagents show that all other plant samples are rich in amino acid, proteins and sugar, Alkaloids, and tannin etc., are present in all the phytodrugs investigated in this study. Thus, Solanum incanum possesses most the nutrients required for healthy growth and since the fruits are mostly added food. Extracts of the fruits possess higher amount of important mineral content and therefore justifying their use as many pharmaceutical applications.

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References


-346-


