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ETHANOMEDICAL, PHYTOCHEMICAL AND PHARMACOLOGICAL UPDATES ON SOLANUM INDICUM LINN: REVIEW

Sudheer Rawat*, Prakash Chandra Gupta and Shubham goutam

University Institute of Pharmacy, C.S.J.M. University, Kanpur (U.P.), India.

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***Corresponding Author**
Sudheer Rawat
University Institute of Pharmacy, C.S.J.M. University, Kanpur (U.P.), India.

ABSTRACT

Solanum Indicum Linn family *Solanaceae* also referred as poison berry in english. This is most important plant in Indian traditional system of medicine in Ayurveda, Unani, and Sidha also useful for treatment of vata, pita, kaphadosha imbalances and also cures vomiting, heart diseases, poisonous affections, skin diseases, ulcers difficult breathing, abdominal pain, cough and dyspepsia. Roots are bitter and pungent that are also eliminate the bad taste of buds and study about phytochemical such as phytosterols, steroidal glycosides, steroidal glycoalkaloids, flavonoids and most common steroidal alkaloids/ glycoalkaloids and there components solasodine, solanidine, solasonine, solamargine and solanine.

KEYWORDS: solasodine, solanidine, solasonine, solamargine and solanine.

INTRODUCTION

Solanum Indicum (Family- Solanaceae) also know as *Solanum anguivi* and *Solanum violaceum*it had major medicinal plant for India traditional system of medicine like Siddha, Unani and Auyrvedic.[1] It is a essential component of the dasamoola (combination of ten root drug) which is used in vata, pita, kaphadosha imbalances on Ayurveda and siddha system of medication also used for treatment of skin disorder, toxic affection, problematic breathing, stomach irritation, ulcers, sore throat, cough and their roots play important role in eliminates poor taste of mouth and tastemaker for food but it roots are very pungent and bitter in taste.[2] The *Solanum* plant, that can be used to treat a verity of aliments like scorpion stings, difficult in urination, dropshy, odema, pest infestation diuretic, asthma, chronic fever. The root of *Solanum* most important medicinal components but leaves and food used on at time use at well around 68 Ayurvedic formulate contain root as a key ingredients. It is

employed as a part of dashamoola combination and other formulation like Amritharisthma, Rajanyadi, Manasamitravatka, Pippalyadi Gridha, their root are essential components of that formulation.

Vernacular Names

Solanum Indicum also called poison berry and in India, it also called badikateri ,Vanabharta and others state like Kerala (Putirichccuntai), Tamilnadu (Puttiriccuntai), Andhra Pradesh (Tellamulaka), Kannada (Ramgulla, Heggula).[3-8]

Solanum Indicum Linn (Figure no-1)

Taxonomy

Kingdom	Plantae
Division	Magnoliophyta
Phylum	Tracheophyta
Class	Magnoliospida
Order	Solanales
Family	Solanaceae
Genus	*Solanum*
Species	Indicum

Botanical Description

It's a 0.3 to 1.5-meter-tall understory shrub. The stems are densely branched, thorny and adorned with compressed, thick and frequently re-curved prickles. The leaves are oval in shape and range in size from 3.5 to 15 centimeters in length. lobed or pinnatifid, cm long, 2.5–8 centimeters broad Sharp or blunt at the tip, pointed at the base, in the margins below, the wool is stellately woolly. Extra auxiliary racemes have blue flowers. The fruit is golden

and spherical, with a diameter of around 1.5 cm. long, ribbed, woody, cylindrical, pale yellowish-brown, 1-2.5 cm in diameter, a number of secondary roots and their branches are evident, although the surface is rough owing to the weather. Fracture, presence of longitudinal striations and root scars short and splintery; no discernible odor or flavor.[8]

Whole Plant- Very spilt, natural and shrub size 0.3 to 1 m in height

Leaves - Massive ovate (Sinuate, lobed, sparsely prickly)

Flower - Blue color or axillary cyme (Stellately hairy, prickly)

Fruits - Yellow and red color there seeds minutely pitted

Seeds - Minutely pitted

Geographical Sources

India (places like roadside, waste lands), Malaya, Sri Lanka, 2000 ft. above the sea.[8,9] And they are also widely distributed in China.[10] and also distributed from Africa, Arbaian peninsula.[11,12,13,14] Thailand, fruits are also available in market.[15]

Nutritional Value

Nutritional value of *Solanum* fruit detect by folin- ciocIteau micro method and compression by supplementary plants such as CordiamyxaRoxb, Momordica dioiciaRoxb, Eulophiaochreatalindl, Alocaciaindica Sch.[16,17] result on the basis of fat greatest nutritional value *Solanum* plant and these oil have contain linoleic, linolenic, T3, T6 fatty acids. This fatty acids are very useful for human body because they are best oil compression to other plant oil, animal oil (fat).

Traditional Used and Therapeutic Effects

Solanum plant reported as bitter (fruit, root) in Indian medicinal traditional system have used in fever, asthma, eliminate bad breath, chest pain, flu, heart problem, vomiting, helpful for leucoderma.8 Basically roots are helpful for vata, kapha problems like respiratory, cardiac problems, skin infections sore throat, dry and wet cough, toxic effects.[2,9,18] and *Solanum* fruit have also helpful for preparation of various traditional remedy like fruit bake with spiced then add in boiled curd used for eating disorder (anorexia), fruit juice with honey is also useful for alopecia. Fruit powder boil in water then add ghee and bake that remedy improve metabolism andkantakari juice mix with brhati add Panchkula that remedy useful for exclude mother's milk child and there fruits or root have also used for snake bite and scorpion sting.[19]

Medicinal Properties

Antimicrobial Effect

Solanum fruits exact are also used for antimicrobial activity in case of Gram negative and Gram positive bacteria parallel with chloramphenicol and its chloroform methanolic extract are also tested by disc diffusion method against bacillus Subtilis, klebsiella pneumonia, Staphylococcus Aureus.[20] Also Stellate trichome were found on the leaves of *Solanum Indicum*. Chloroform, acetone, and ethanol extracts of *Solanum Indicum* leaves exhibited antibacterial action against Staphylococcus aureus, Bacillus cereus, and Escherichia coli, where as chloroform, acetone, and ethanol extracts showed antibacterial activity against pseudomonas. Towa's aqueous extract showed no antimicrobial action.[21]

Nematicide Activity

Solanum leaves extract are work as a type of chemical pesticides used to kill plant parasitic nematodes (70% to 80 mortality) analysed by in vitro study.[22]

Hepatoprotective

Solanum fruits extract are also gives strength of hepatoprotective that are examined by protect rats damage liver induced by paracetamol.[23] and their ethanolic extract of fruit also work as hepatoprotective and antioxidant activities.[24]

Anti-inflammation

In taiwan *Solanum Indicum Linn* used as a traditional system for wound inflamed toothache, edema, ascites because they contain Solanine alkaloid, they also used in polyuria, polydipsia.[25]

Antioxidants

The existence of alkaloids, glycosides, and other compounds was discovered in this investigation during the phytochemical process, steroids, saponin, flavonoids, and sugar are produced investigation. When TLC profiling is used, the presence of solanine in the sample is determined. The presence of chloroform extract was verified. The test also validated the hypothesis. Solanine may be found in ethanolic and chloroform extracts. The unpolished The antioxidant properties of a plant medicine was assessed utilizing Using the DPPH scavenging method, the Carotene assay method, and total phenolic content. It was discovered that ethanolic and aqueous extracts had the most potential antioxidant activity was high. In light

of the observed data, it may be deduced that the plant contains important phytochemicals components, as well as having strong antioxidant properties.[26]

Antiplasmodial

In vitro testing of the antiplasmodial efficacy of ethanolic fruit extract against the chloroquine-resistant plasmodium falciparum FcB1 strain was performed. On the basis of cytotoxicity, the rat L-6 cell line (IC50 >50g/mL) and the human MRC-5 cell line (IC50 >50g/mL) are two cell lines that have been studied (>50g/mL). The antimalarial activity of plant extracts was shown to be considerable.41.37.0 g/Ml (IC50) activity.[27]

Gastric Ulcer

On aspirin and ethanol-induced ulceration in rats, the anti-ulcerogenic properties of the methanolic extract of *Solanum Indicum* var. distichum fruit were studied. The extract (750 mg/kg) not only protects the stomach mucosa from harm, but also helps it to heal, not only does it reduce the effects of aspirin and ethanol, but it also accelerates wound healing, ulcer. Antioxidant indicators such as glutathione, SOD, GR, CAT, and LPO were restored, indicating that the impact was likely attributable to its antioxidant capacity.[28]

Anti Hypertensive

The effects of a standardised ethanolic extract of the *Solanum Indicum* ssp. distichum fruit (containing > 0.15 percent chlorogenic acids) on blood pressure in both normotensive and hypertensive patients were studied. (N(W)-nitro-L-arginine methylester) and hypertensive rats who had been medicated the extract therapy lasted four weeks (30 days). In normotensive rats, mg/kg) had no effect on blood pressure. It does, however, hinder the animal from developing following the injection of L-NAME, hypertension develops.[29]

CNS Depressant

After being given a methanolic extract of fruit, the spontaneous locomotor activity of adult wistar albino rats was assessed. The extract (500 mg/kg) had the highest locomotor activity after one hour, inhibitory activity. The medication has a depressive effect on the central nervous system was shown to be substantially superior to the usual medication 0.5 mg/kg diazepam.[30]

Phytoconstituents Investigation

The whole plant of *Solanum Indicum* present many natural constituents *Solanum* such as flavonoids, steroidal glycoalkaloids, steroidal glycosides some fatty acids etc 31. And fruits are also contain crude fibre (8% wet weight), total carbohydrate (40.67% wet weight), crude protein (23.47% wet weight), total ash (22.66% wet weight), crude fat (5.26% wet weight) and caloric value of (303.9 wet weight) and some part of alkolides, polyphenol and saponins 32, 33 and the plant also contain steroidal glycosides and steroidal glycoalkaloids and leaves contain 0.32 and fruit contain 0.2 to 1.8 portion of alkaloids 0.32 total alkaloids. 34. The major chemical constituent of plant are steroidal alkaloids and steroidal glycoalkaloids contains solasodine, solanidine, solasonine, solamargine and solanine.[31,34,35] that are secondary metabolites used for environmentally safe and human wellness.[36] the glycoalkaloides are contain two natural constituent aglycone and glycone the aglycone are consist of unit possess the basic steroidal 27-carbon skeleton (cyclopentanophenanthrene) of cholestane with nitrogen incorporated into the F ring, which is amiphiphilic in nature and glycone consist of attached to th 3-OH position since nitrogen is inserted into a non-amino acid residue these compounds belong to a subgroup of pseudo alkaloids or isoprenoid alkaloids.[37,38] and other steroidal glycoside indiosides, isoanguivine, protodio indiosides, isoanguivine, protodioscin, steroidal alkaloids solamargine, solasonine, coumarins (scopoletin, biisofraxidin, arteminorin A, cleosandrin, amide [N- (p-trans-coumaroyl) -tyramine] sesquiterpenes (solavetivone, solafuranone) and coumarinolignoids, indicumines.[39,32,38,40]

Minor Constituents

Carotene, carpesterol, solanocarpone, diosgenin, β-sitosterol, lanosterol, solavetivone, solafuranone, scopoletin, tyramine, N-trans-feruloyltyramine and indiosides.

Coumarines

Isofrexidin, fraxetin are isolated from *Solanum Indicum* seeds that are characterized by 1D and 2D spectroscopic data (figure no 2) (E)-2-(4-hydroxy-3-methoxybenzylidene)-5-methoxy-2H-[1,4] dioxino[2,3-h]chromene-3,9-dione (indicumin E, 1) and 7-hydroxy-6,8-dimethoxy-3- (40 -hydroxy-30 -methoxyphenyl)-coumarin (2) together with two known coumarins isofraxidin (3) and fraxetin (4).[41]

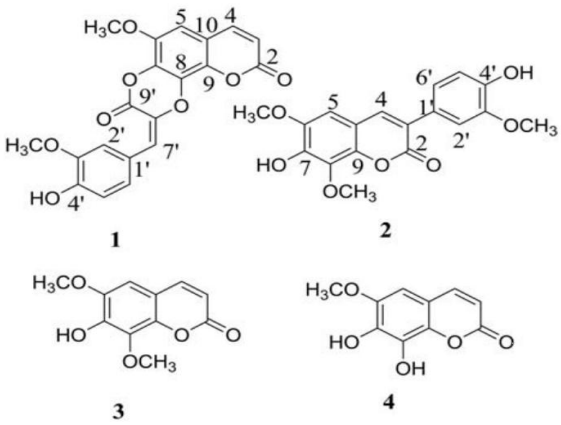

Figure No– 2.

Spirostanoid Saponin

The fruit of solnum indicum consist of two new 23S and 26 R hydroxylated Spirostanoid Saponin. They are very rare chemical components and five components are know 2 are very rare components natural ketosteroids 6- hydroxyandrosta-1, 4-diene-3, 17-dione, rostadienedione and both are characterize by different – different spectroscopic method 2D NMR and UV HRESIMS etc. 31 and there Along with indioside A and protodioscin, indioside F(figure no 3) was isolated from the fruit of *Solanum Indicum*. The structure of indioside F was discovered by spectroscopic method found to be 3 -O -a-L-rhamnopyranosyl- (1→2) -[a-L-rhamnopyranosyl-(1→4)] -b-D-glucopyranosyl (b-chacotriosyl) (22R,23S,25R,26R) -spirost-5-ene-3b,23,26-tri.[42]

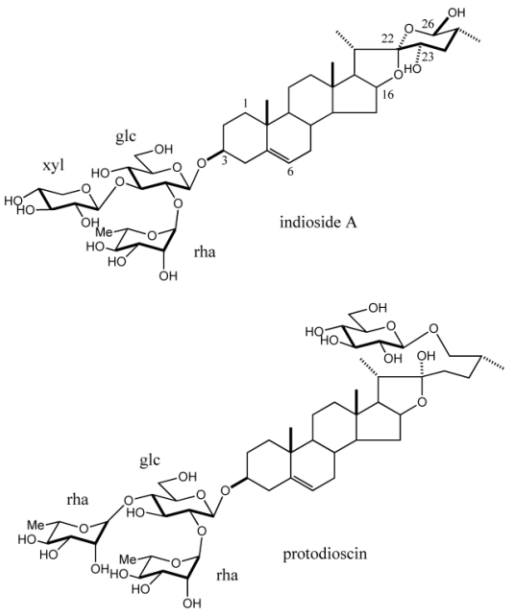

Figure 3:

Assay

Cytotoxic Assay

Compounds 1–2 were tested for cytotoxicity against five human cancer cell lines which are grow from DMEM medium or RPMI-1640 4-{5-[3-(carboxymethoxy)phenyl]-2- (4,5-dimethyl-1,3- thiazol- 2-yl)-2H-tetrazol-3-ium-3-yl}benzene-1-sulfonate (MTS) assay.[33] Cells were inoculated with 3000-15000 cells per well in RPMI-1640 or DMEM media with 10% foetal bovine serum, seeded into a 96-well cell culture plate with a volume of 100 L each well, and maintained at 37 °C. 48 hours in the incubator DMSO was used to dissolve the chemicals. 100 litres after 48 hours each well's supernatant culture solutions were removed and 20 litres of MTS solution were added. The samples were then cultured for another 4 hours. In each experiment, cisplatin (DDP) and taxol compounds were employed as positive controls. The concentration was displayed as the abscissa and cell viability as the ordinate on a cell growth curve. At 492 nm, the optical density (OD) was determined. ULTISKAN FC was used to calculate the inhibition rates of the five strains.[43]

Antifungal Assay

The experiment was carried out in Potato Dextrose medium (Scientific Research Special), as described by Y. Liu et al. In the wells of the 96-well plates, a volume of 100 L aliquot from the stock solutions of the samples that had been previously produced was added. In each well, 100 L of inoculum was introduced to reach a final inoculum concentration of 1 105 CFU/mL. The ultimate capacity in each well was set to 200 litres. The reference drug was amphotericin B (Sigma-Aldrich). Plates were scanned at 625 nm after 24 hours of incubation at 37 °C to calculate the inhibitory rate of C. albicans - ATCC 10231. (Microbiologics).[35]

Anti inflammatory

RAW264.7 cells (Cell Bank of Chinese Academy of Sciences, Shanghai, China) were injected onto 96-well plates and stimulated with 1 g/mL LPS and a test chemical, as previously described by N. Soonthornsit et al..An L-NMMA-positive drug group and a drug-free group were created (Sigma-Aldrich) in the capacity of management The medium was collected after the cells had been grown overnight to detect NO generation, and the absorbance was measured at 570 nm. To remove the harmful effects of the chemicals on the cells, MTS was added to the residual medium for the cell viability experiment.NO of production inhibition rate (%) = (non-drug treatment group OD570 nm - sample group OD570 nm) / non-drug treatment group OD570 nm × 100%.[36]

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