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Ethnopharmacology of *solanum nigrum*: A review

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Abstract

OCD is a syndrome characterized by obsessions and compulsions, as well as other neuropsychiatric features, and is often associated with primary psychiatric disorders and various neurologic conditions. If severe, OCD can seriously interfere with the patient's quality of life. The mainstay of treatment is psychotherapy, especially cognitive-behavioural therapy, and pharmacologic interventions, especially selective serotonin reuptake inhibitors (SSRIs). Unfortunately, a significant proportion of patients are refractory to these treatment modalities. A new understanding abuts the neurobiology of OCD has led to novel investigational treatments, especially neuromodulation techniques.

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Introduction

S. nigrum (sn) is a dicot weed in the solanaceae family that is also known as Black Nightshade. *S. nigrum Linn. (Sn)* is a dicot weed in the Solanaceae family that is generally known as Black herb which is used to treat a variety of diseases in children. That are primarily responsible for neonatal mortality Convulsions with a fever. Sn is a branching annual herb that reach heights of 90 cm, with dull dark green leaves that are juicy and oval in shape [1]. There will be two kinds of *Solanum nigrum*, one with black fruit and one with reddish brown fruit. Both types of black fruit are poisonous. The leaves, entire plant, and roots are used for medical uses [2]. This study examined the effects of *Solanum nigrum* leaf and berry extracts on ethanol-induced gastritis and aspirin-induced stomach ulcers in pylorus-ligated rats [3]. *Solanum nigrum*, also known as "Black night shade," is a member of the Solanaceae family. Manathakkali is the Tamil word for it. It contains antimicrobial, oxidative, and cytotoxic effects, as well as antiulcerogenic and hepatoprotective properties. It is a paediatric herb from Africa that is used to treat a variety of diseases that cause infant death including feverish convulsions, eye diseases, hydrocephalus, and chronic skin conditions. It's an anti-cancer herbal alternative [4]. In some parts of Nigeria, the leaves and seeds (berries) are used as a vegetable in soups, yam and coco yam porridges, and as spinach. The effects of *Solanum nigrum* leaf and berry extracts on ethanol-induced gastritis and aspirin-induced stomach ulcers in pylorus-ligated rats was explored in this

study. Especially among the Igbo and Efik-Ibibio in South-Eastern Nigeria. Aside from human use, the leaves were used as fodder and browse for domestic herbivorous animals [5]. The taxonomy of the black nightshades, that are mostly herbaceous or shrubby plants, is still being worked out. Prior to the 1980s, most weed references to black nightshade simply referred to the species *S. nigrum L* [6]. *S. nigrum* has traditionally been used to treat a wide variety of diseases, including pain, inflammation, and fever. Plants are used in Oriental medicine for a number of purposes, including anticancer, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic effects. Many chemicals responsible for various activities have been discovered [7]. The plant *Solanum nigrum L.*, popularly known as 'hierba mora,' is a common herb that grows wild and abundantly in open fields, and the fruit of which has been used as a nerve tonic in traditional Mexican medicine. According to firsthand interviews conducted in rural communities around the state of Hidalgo, the fruit is indeed used to cure nerve problems [8].

Taxonomical Classification [9] Table: 1

Division	Embryophyta
Sub division	Angiospermae
Class	Dicotyledoneae
Order	Tubeflorae
Sub order	Solanales
Family	solonaceae
Genera	solonam
Division	Embryophyta
Sub division	Angiospermae
Class	Dicotyledoneae
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Vernacular Names [10] Table: 2

Country	Names
Australia	Black nightshade, Black berry nightshade;
Cameroon	Kumbo (Banso);
Europe	Black nightshade, annual nightshade, common nightshade, garden nightshade;
France	Morelle noire;
Russia	Paslen cernyj
Italian	Solano nero, solatro

Morphology

S.Nigrum is a 25–99 cm long, upright herbaceous perennial with overgrown simple hairs. Stems that are angular and sparingly hairy are prevalent. The berries are spherical and matte black in colour, approximately 8 to 10 mm in size. The blades are rectangular with cuneate margins, 4–10 and 3–seven cm in width, glabrous, coarsely dentate, and obtuse. The presence of inflorescences is an added feature. Extraaxillary umbels with cup-shaped axils, white corollas, and pubescent abaxially and ciliate extending ovate-oblong lobes. The filament is 1–1.5 mm in length and the anthers are 2.5–4 mm long [11]. The wood is thinner and readily peeled away, revealing pale yellow wood beneath. The flowers have five petals and have a regular form. They might be circular and flat or star-shaped, although they are most commonly bell-shaped or tubular. Members of this group are often climbers or jammers. Plants

with hairy leaves and stems. The leaves vary in size and shape, and can be whole or split. They are generally alternate, dissected, and without stipules. The morphological analysis reveals the root externally, it is smooth and pale brown, with a few branches and many little lateral roots. The fruit has a thin, papery epicarp, a pulpy mesocarp, and axile placentation; the seeds are free in the pulp. It is a type of fruit. Berries with a size of 6 micrometres and an obtuse shape are typical [12].

Fig: 1 leaf of *s.nigrum*Fig: 2 fruit of *s.nigrum*Fig: 3 flower of *s.nigrum*Fig: 4 stem of *s.nigrum*

Pharmacological actions of *solanum nigrum*

Antimicrobial activity

Antibacterial activity was investigated in ethanol and aqueous extracts of *Sn* leaves, and phytochemical analysis was used to identify the chemicals involved. *Escherichia coli*, *Staphylococcus aureus*, *Enterobacter aerogenes*, and *Pseudomonas aeruginosa* were examined using methanol and water extracts. Zones of growth inhibition, which varied based on the microorganism and extracting solvent, were used to measure the bacteria's susceptibility to crude extracts. The ethanolic extracts produced the highest activity as compared to the aqueous extract. The organisms used in this investigation had previously been associated with diabetes-related opportunistic illnesses. This was acceptable to conclude that methanol can be used to extract antibacterial compounds from leaves depending upon these findings [13].

Methanolic preparations of dried root tissues of black nightshade, which act against *A. brassicicola*, have antifungal properties. Root extracts in ethyl acetate, n-butanol, and water were separated and tested for antibacterial activity, with n-butanol extracts proving to be the most effective [14].

Antidiabetic activity

The effect of crude ethanolic extract of *S. nigrum* on blood sugar in albino rats after daily oral administration of a dose of 250 mg/kg b.wt. for five and seven days was also investigated. Chronic administration over a longer period of time results in a decrease in blood sugar as compared to the control. As a result, *Sn* anti-diabetic property can be concluded [15].

Anti-HCV activity

At non-toxic concentrations, methanol and chloroform extracts of Sn seeds inhibited HCV by 37% and more than 50%, respectively. Additionally, the seeds of *Solanum nigrum* demonstrated antiviral activity. Transecting HCV was used to examine the NS3 protease. The plasmid encoding the NS3 protease was inserted into liver cells. According to the results, HCV NS3 expression and function were lowered by *Solanum* chloroform extracts. GAPDH and protease remained constant in a dose-dependent manner. These results indicate that Sn extract is useful in combination with antiviral drugs that may be helpful against HCV and that *sn* extract and interferon should be used together. Alternative treatment for chronic HCV [16].

Analgesic activity

The analgesic effectiveness of *Solanum nigrum* ethanolic extracts was tested. The extract's analgesic activity was tested for central and peripheral pharmacological activities using Eddy's hot plate and acetic acid induced writhing. The study employed oral doses of 100, 250, and 500 mg/kg. The extract had a significant analgesic effect at 500 mg/kg (P0.01) when compared to the reference drug Diclofenac sodium (50 mg/kg) [17]. The analgesic activity of an ethanolic extract of *S. nigrum* leaf extract fruit was examined. When mice were given acetic acid to induce writhing, the ethanolic extract (250 and 500 mg/kg, respectively) decreased the writhing reflex by 51.39 percent and 66.67 percent, respectively, when compared to Diclofenac sodium. It demonstrates that analgesic activity is beneficial [18].

Anticancer activity

The anticancer effect of *Sn* fruits was studied using the HeLa cell line. On the HeLa Cell Line, the inhibition effect of *Solanum nigrum* methanolic extract was studied. To evaluate the cell line's percent viability, the Trypan blue dye exclusion method was utilised. *Sn* cytotoxicity on HeLa cells was assessed using the SRB and MTT tests. *Sn* methanolic extract was found to have a significant cytotoxicity effect on HeLa cell lines using the SRB assay at doses ranging from 10 mg/ml to 0.0196 mg/ml [19].

Antidiarrheal activity

An ethanolic extract of the dried fruit of *Sn* was studied for its antidiarrheal activities. The fruit extract had a significant (P0.01 and P0.001) antidiarrhoeal effect in rodents when given at doses of 250mg/kg and 500mg/kg body weight, reducing the frequency of faeces and increasing the mean latency period [20].

Cardioprotective activity

The cardioprotective effect of an ethanolic of *Sn* berries was examined utilizing global in vitro ischemia-reperfusion injury at doses of 2.5 and 5.0 mg/kg for 30 days, six days per week. According to the findings, the extract had a considerable (p0.001) cardioprotective impact against global in-vitro ischemia-reperfusion injury. The action was unaffected by the dosage. A ethanol extract of *Sn* berries was discovered to have a cardioprotective effect [21].

Anti gastritis and antiulcerogenic effects

Stomach ulcers, gastritis, and other gastrointestinal problems are frequently cured using Sn leaves and berries in South India. In this study, scientists analyzed the effects of *Solanum nigrum*

leaf and berry extracts on ethanol-induced gastritis and aspirin-induced stomach ulcers in pylorus-ligated rats. Sucralfate and ranitidine were the drugs. Oral administration of aqueous extracts of leaf (80 mg/kg and 250 mg/kg, respectively) and berry (50 mg/kg) significantly reduced the concentration of Evans blue in both gastrointestinal contents and glandular tissue as compared to the control, having low vascular permeability and mucosal injury. The berry aqueous extract was more effective than the leaf extracts in reducing gastritis. Pretreatment was done with leaf aqueous extracts (250 mg/kg) [22].

Anti-seizure activity

After intraperitoneal injection of the extract, the anti-seizure activity of an aqueous extract of *S. nigrum* leaves was tested in chicks, mice, and rats. After a 30-minute pre-treatment period, animals were given different types of proconvulsants in different amounts. The results show that aqueous leaf extract protected chicks and rats in a dose-dependent manner against electrically induced seizures, pentylenetetrazoles-induced seizures in mice and rats, and picrotoxin-induced seizures in mice and rats. Amphetamine enhanced the extract's anti-seizure effects [23].

Antioxidant activity

A tissue biochemical anti-oxidant profile was used to measure the anti-oxidant activity of a methanolic extract of *Sn* berries. The antioxidant capacity of the extract showed to be significant (p0.001) in heart tissue biochemical antioxidant profile. Regardless of the dose, the action happened. A methanolic extract of *Solanum nigrum* berries was found to have antioxidant properties [24].

Immunomodulation activity

SNL-P treatment restored the ratio of CD4+/CD8+ peripheral blood T-lymphocyte sub - populations in in vivo tests. Furthermore, as assessed by the ELISA method, SNL-P treatment resulted in a significant increase in IFN- (p 0.01, 90, 180, and 360 mg/kg bw) and a significant decrease in IL- (p 0.05, 360 mg/kg bw). In U14 cervical cancer-bearing rodent, these data demonstrated that SNL-P has strong anticancer activity, and that it may do by stimulating different immune responses in the host rather than directly eliminating cancer cells[25].

Hepatoprotective activity

The hepatoprotective efficacy of a *Solanum nigrum* Linn. ethanol extract against CCl4-induced liver damage in rats was examined. Hepatoprotective effects of ethanol extract The activity was measured utilising biochemical markers such as serum aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), and total bilirubin. The histopathological changes in the livers of treated and untreated mice were compared [26].

Anti-tumor activity

Polysaccharides from *Sn* Linne were studied for their anti-tumor impact and their association with the immunological function of tumor-bearing species. Different dosages of polysaccharides from *Sn* Linne significantly suppressed the growth of mouse H22 solid tumours, enhanced the survival time of tumor-bearing mice, boosted lymphocyte proliferation, elevated IL-2 levels, and increased calcium ion concentration in lymphocytes. *Solanum nigrum* Linne polysaccharides have an

anti-tumour activity that is linked to the cellular immunological function that governs the body [27].

Anti-larvicidal properties

The biocontrol ability of an active component obtained from a mature *Sn L.* (Solanaceae) leaf ethyl acetate extract was evaluated. The data revealed that there is a clear dose-dependent mortality because the rate of death (Y) was strongly associated with the concentrations of the substance (X) and the regression value of the coefficient was similar to 1[28].

Anti-hyperlipidemic effect:

In hyperlipidemia animals treated with lipofundin, the ethanolic extract of *Sn* lowered cholesterol levels *in vivo*. In animals, slow intravenous infusion of 20% lipofundin in an insignificant ear vein for 7 days resulted in hyperlipidemia @ 2 ml/kg body weight. For the next fourteen days, the benchmark group was given a regular diet, whereas the experimental group was given 300 mg/kg body weight of ethanolic unrefined *Solanum nigrum* concentrate. Following the end of therapy, blood samples from both the control and test groups were obtained and lipid profile values were calculated. The Test group had a higher level of blood absolute cholesterol, fatty substance, high thickness lipoprotein, and low-thickness lipoprotein after treatment with ethanolic concentrate of *S.Nigrum*. Following that, the current study found that *S. nigrum* is a fungus [29].

Estrogen activity:

The phytoestrogen ability of *Solanum nigrum* fruits was evaluated using *in vitro* and *in vivo* tests. The findings indicate that *Solanum* compounds exhibit hormone-like activity *in vitro* and *in vivo* in rodents, which requires extra study to identify the mechanism and clinical implications[30].

Anti-stress activity:

For preventive and curative purposes, the antioxidant activity of crude extract and the active constituent of *sn* leaves was studied. The brain appears to be sensitive to stress-induced prooxidant damage due to the high fat content. As a result, the *Solanum nigrum* leaves extract or its isolated constituents can be used as a dietary supplement to scavenge free radicals produced in the brain as a result of physical or psychological stress, and any neuronal diseases per sec [31].

Neuro pharmacological effect:

In Wistar rats, the neuropharmacological properties of an ethanol extract of *S.nigrum Linn.* fruit were investigated. On experimental animals with ethanolic extract, pentobarbital-induced sleeping time, motility test, exploratory behaviour pattern (head dip test, Y-maze test, evasive test), motor incoordination test (Rota rod test, Chimney test, traction test, inclined test), anticonvulsant activity, and other neuropharmacological tests were performed. In the above-mentioned experiments, the fruit extracts exhibited dose-dependent efficiency. The extract reduced alertness and restlessness when given at a dose of 255mg/kg. There have been no tremors, twitches, convulsions, or a straub tail response. Alarm, reaction, body posture, limb position, gait, righting reflex, muscular tone, pinna, and corneal reflexes had no effect on the results. This finding leads to the conclusion that the extract's depressed effect on locomotory functioning is a consequence of this discovery [32].

Immunostimulant activity

Before being challenged with heat-killed *Aphanomyces invadans*, six groups of experimental fish (*E. suratensis*) were given 0.2ml (4ppm) of five different *Solanum nigrum* extracts through intra-peritoneal injection. On blood from immunised and non-immunized fish, radial immunodiffusion, antibody titration, nitro blue tetrazolium assay, determination of IgG concentration, and host resistance test were all performed. In both the control and experimental groups, the maximal antibody response occurred on day 21 after immunisation, and then declined until the 28th day. The antibody response in the methanol extract treatment group was improved significantly on days 14 and 21. (p0.05). on day 21, the highest level of IgG was reached, and it steadily decreased until day 28. The Chloroform extract treatment significantly increased neutrophil activity on day 6 [33]

Cytotoxicity effect

cytotoxic effect of an ethanolic extract of *sn L.* dried fruit In the brine shrimp lethality test, the extracts exhibited cytotoxicity, with LC50= 63.10g/ml and LC90= 160g/ml [34].

Conclusion

We conclude from the vast literature study and experimental results analysis that *solanum nigrum* is a traditional remedy for antimicrobial activity, antidiabetic activity, anti HCV activity, analgesic activity, anticancer activity, anti diarrhoeal activity, cardioprotective activity, anti gastric activity, anti seizure activity and antioxidant activity.

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