Chapter 5

Ethnomedicinal and pharmacological uses of *Solanum sisymbriifolium* Lam., (Solanaceae)

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Abstract: *Solanum sisymbriifolium* Lam., commonly known as the Sticky Nightshade or wild tomato, is a shrub with substantial ethnomedicinal and pharmacological potential. Present chapter provides an inclusive overview of its traditional uses and scientific validation. Ethnomedicinally, various parts of the plant are used to treat a range of ailments. Pharmacological studies have corroborated many of these traditional uses, revealing the presence of bioactive compounds such as alkaloids, flavonoids, and steroidal saponins. Research has demonstrated the plant's diverse properties, including antimicrobial, anti-inflammatory, antioxidant, and cytotoxic activities. This chapter synthesizes current knowledge on the plant's phytochemistry, ethnomedicinal uses and biological activities, highlighting its potential as a source of novel therapeutic agents.

Keywords: Bioactive compounds, medicinal plants, pharmacology

Introduction

Solanaceae is an important family that comprises both economic as well as medicinal uses such as potato, tomato, eggplant, and peppers are the most important crops that belongs to this family (Zanit et al., 2022). *Solanum* is a large family comprises of 102 genera and over more than 2500 species of

trees, shrubs and herbs belonging to the family Solanaceae (Chidambaram et al., 2022). Mostly *Solanum* species are preferred for food as well as medicinal aspects. Due to availability of such rich traditional uses it also contains varied phytochemical compounds such as alkaloids, flavonoids, tannins (Kaunda and Zhang, 2019; Dahiya et al., 2025). *Solanum sisymbriifolium* Lam., a species belonging to the large and diverse family Solanaceae, is a perennial herb characterized by its deeply lobed, spiny leaves and striking white or pale violet flowers (Chauhan et al., (2011). Commonly known as sticky nightshade, litchi tomato, or dense-thorned nightshade, this plant is native to South America but has become naturalized in various parts of the world, often growing as a weed in disturbed areas. In India, Andhra Pradesh, Assam, Bihar, Kerala, Karnataka, Maharashtra, Manipur, Odisha, Punjab, Sikkim, Tripura, Uttar Pradesh and West Bengal (Panda et al., 2023). Among *Solanum* species*, Solanum sisymbriifolium* is prove to the abundant medicinal value which could aid in curing different ailments. Compound classes including steroidal saponin, spirostane saponins, glycol-alkaloids, steroidal alkaloids, pyrrolidine alkaloids, sterols, steroid glycosides and lignans from different parts (More, 2017). Steroidal saponin Isonuati-genin-3-O-b-solatriose, spirostane saponin, nuatigenosido, a rare natural steroidal sapogenin and nuatigenin-3-O-b-chacotriose in the roots. Two steroidal alkaloids, solamargine and b-solamarine, were isolated from a methanol extract of *S. sisymbriifolium* fruit. Neolignan and Sisymbrifolin isolated from berries (More, 2017; Momen et al., 2020). Despite its weedy nature, *S. sisymbriifolium* holds significant value in traditional medicine systems across different cultures (Biswas et al., 2023). Its ethnobotanical history is rich, with indigenous communities utilizing various parts of the plant, including the roots, leaves, and fruits, to treat a wide array of ailments. The therapeutic

applications are vast, ranging from fever reduction and pain relief to addressing more complex conditions like inflammatory diseases and snakebites. The traditional uses of *S. sisymbriifolium* are a testament to its perceived medicinal properties (Biswas et al., 2023). In various folk medicine traditions, decoctions prepared from the roots and leaves are consumed orally to manage gastrointestinal issues, such as stomach aches and dysentery. The plant's antipyretic properties have been exploited for centuries to alleviate fevers, while its analgesic effects have made it a popular remedy for body aches and rheumatism. Furthermore, poultices made from crushed leaves are topically applied to wounds, cuts, and skin infections, leveraging the plant's antiseptic and wound-healing potential (More et al., 2017). The fruit, often resembling a small, spiny tomato, is also consumed in some regions, though its edibility and medicinal use are debated and vary depending on local traditions and the specific chemotype of the plant (Biswas et al., 2023).

Modern pharmacological research has begun to validate and shed light on the scientific basis of these traditional uses. A key focus of this research has been the phytochemical analysis of *S. sisymbriifolium*, which has revealed a rich profile of bioactive compounds. The plant is particularly known for its high content of steroidal alkaloids, such as solasodine, which have been linked to a variety of pharmacological activities (Chauhan et al., 2011). Other significant compounds include flavonoids, saponins, and phenolic acids, all of which contribute to the plant's therapeutic potential. These secondary metabolites are responsible for the plant's documented pharmacological effects, including anti-inflammatory, antioxidant, antimicrobial, and cytotoxic properties. The diverse pharmacological activities of *S. sisymbriifolium* have opened new avenues for its potential in drug discovery (Momen et al., 2020). Studies have shown that extracts from the plant exhibit

potent anti-inflammatory effects, which could be beneficial in managing chronic inflammatory conditions. Its antioxidant capacity helps in neutralizing free radicals, thereby protecting cells from oxidative stress and potentially mitigating the risk of various diseases. Furthermore, the plant's antimicrobial properties have been demonstrated against a range of pathogens, suggesting its potential in developing new antibacterial and antifungal agents (Vaghela et al., 2009). Perhaps one of the most promising areas of research is the investigation of the cytotoxic effects of its steroidal alkaloids on cancer cells, with some studies indicating their potential as chemotherapeutic agents. Henceforth, *S. sisymbriifolium* represents a fascinating plant for both ethnobotanical study and modern pharmacological investigation, bridging the gap between traditional wisdom and scientific validation. Its rich history of use and diverse phytochemical profile underscore its potential as a valuable source for new therapeutic compounds.



Figure 1: Habit of *S. sisymbriifolium*



Figure 2: Flower of *S. sisymbriifolium*



Figure 3: Leaves and ripen fruit of *S. sisymbriifolium*

Morphology: It is an erect annual or perennial undershrub upto 3m high, mush branched, woody at base, glandular stem with dense prickle, simple and stellate hairs. Leaves are simple or sometimes pinnate, pinnately lobed or parted, lobes pinnately lobed or dentate, apex acute. Inflorescences axillary. Corolla white, stellate. Fruiting calyx enlarged, densely prickly, and enveloping, most berries. Seeds reniform. (Sahu et al., 2017: Figure 1-3).

Methodology

Through tentative literature and field survey it revealed a wide array of ethnomedicinal uses and through literature survey it revealed its pharmacological values. Literature data was gathered from Scopus, Web of Science, Springer, PubMed, Google Scholar, using search terms "*S. sisymbriifolium*, "phytochemistry", "Pharmacology"," ethnomedicinal uses", MDPI, Science Direct, SciFinder, Scirus, and Scientific Electronic Library Online (SciELO) from 2020-2025 (Jena et al., 2025; Kumar, 2025).

Results and discussion

The study reveals the various plant parts used to treat different ailments, showcasing the versatility of the plant in traditional knowledge. The root is used as a decoction for its diuretic and contraceptive properties, while the aerial parts are utilized to treat diarrhoea, respiratory, and urinary tract issues. The flowers are used as an analgesic, and the leaves are employed to treat fever, cough, and as a diuretic. Notably, the leaves and fruits are also used as contraceptives, highlighting the plant's potential in reproductive health. In Table1, it suggests that the plant's diverse phytochemical composition may be responsible for its broad range of medicinal properties. Mostly the mose of uses are obtained as decoction, infusion, and paste. The use of different plant parts for various ailments indicates a sophisticated understanding of the

plant's properties and potential applications. According to literature view, it supports the plant's significance in traditional medicine and warrant further investigation into its pharmacological potential and phytochemical constituents.

Table 1: Ethnomedicinal uses of different parts of *S. sisymbriifolium*

Plant parts	Mode of consumption	Different ailment	Sources
Aerial part	Decoction	Diarrhoea, respiratory and urinary tracts	Prajapati et al., (2013)
Flowers	Decoction	Analgesic	Vaghela et al., (2009); Prajapati et al., (2013);
Fruits	Decoction	Contraceptive	Vaghela et al., (2009); More, (2017)
Leaves	Decoction	Febrifuge	Prajapati et al., (2013)
Leaves	Decoction	Diuretic	Vaghela et al., (2009); More, (2017)
Leaves	Decoction	Cough	Tumpa et al., (2014)
Leaves	Infusion	Stomach pains	Nayak and Kumar, (2023)
Root	Decoction	Diuretic, contraceptive	Prajapati et al., (2013)
Root	Decoction	Epilepsy	Kumar et al., (2022); Nayak and Kumar, (2023)
Roots	Paste	Cuts and wounds	Nayak and Kumar, (2023)

The *S. sisbriifolium* exhibits a wide range of pharmacological activities across its various parts. The root shows promise in treating syphilis and hypertension, while the aerial parts demonstrate antioxidant and antimicrobial properties, which could be valuable in preventing chronic diseases and infections. The leaves have been found to possess antibacterial, analgesic, and antidiarrheal properties, making them a potential natural remedy for pain management and gastrointestinal issues. The fruits exhibit

insecticidal and anticonvulsant activities, suggesting potential uses in pest control and neurological disorders. Interestingly, the aerial parts, unripe fruits, and ripe fruits have been studied for toxicity, with some plants showing low toxicity profiles. In Table 2, *S. sisbriifolium* shows diverse pharmacological activities make it a valuable resource for developing new therapeutic agents. Further research could fully explore its potential and ensure safe usage.

Table 2: Pharmacological values of different parts of *S. sisymbrifolium*

Plants parts	Pharmacological activities	Sources
Aerial part	Antioxidant and anti-microbial activity	More, (2017); Momen et al., (2020)
Aerial part, unripe fruit and ripe fruit	Toxicity activity	More, (2017); Momen et al., (2020)
Fruit	Insecticidal activity	More, (2017)
Fruit	Anti-convulsant activity	More, (2017)
Leaves	Antibacterial activity	Gebrewbet and Hndeya, (2023)
Leaves	Analgesic activity	More, (2017)
Leaves	Anti-diarrhoeal activity	More, (2017); Biswas et al., (2023)
Leaves and stem	Anti-fungal activity	Vaghela et al., (2009); More, (2017)
Root	Anti-syphilitic activity	More, (2017); Biswas et al., (2023)
Root	Anti-hypertensive activity	More, (2017); Arrua et al., (2024)

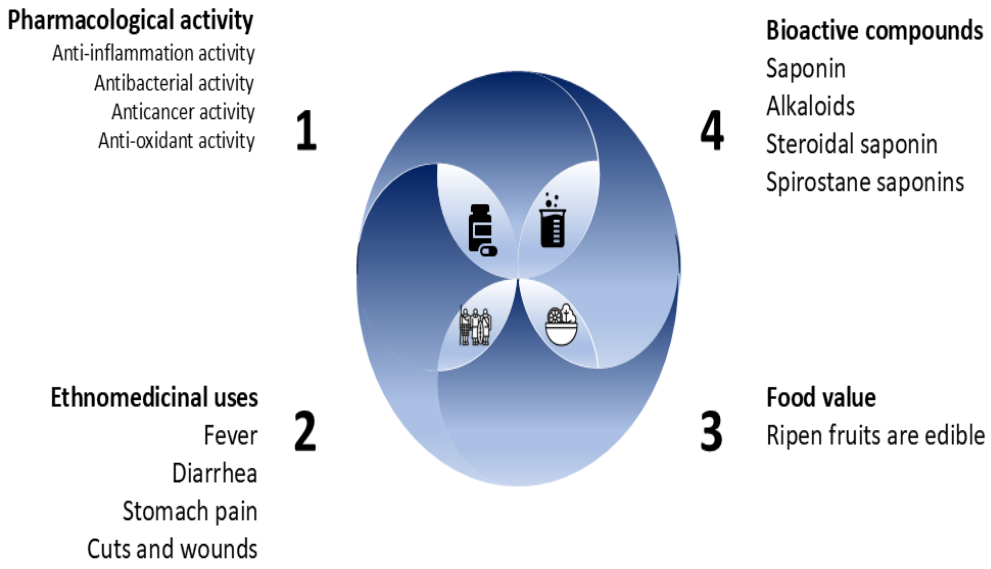


Figure 4: Illustrated explore its application for further future aspects of *S. sisymbriifolium*

Conclusion

Solanum sisymbriifolium Lam. is a valuable plant species with a rich antiquity of ethnomedicinal uses and scientifically validated pharmacological properties. Its diverse range of bioactive compounds and therapeutic effects make it a promising source for developing new medicines. Further research and development are needed to fully harness its potential and explore its applications in modern medicine (Figure 4).

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