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Review Paper

The Genus *Solanum*: A Review of Its Species and Medicinal and Traditional Uses

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ABSTRACT

Solanum species has many medicinal plants which belong to the family solanaceae. Some of great medicinal plant in this species are *Solanum aculeastrum*, *Solanum sandwicense*, *Solanum torvum*, *Solanum quadriloculatum*, *solanum nigrum*, which is used as medicinal herb from very long time. Now a day's plants are used to make more effective and less side effect medicine. In recent times, commercial cultivation of such species has been done for extraction of compounds like Solasodine and Solasonin for pharma logical purposes. However, these species are neglected when it comes to research and development, especially in crop improvement aspects. Much work is needed in the area of genetic improvement in these plants to make them more feasible for cultivation and utilization of their pharmaceutical potential. The study has revealed 10 species of *Solanum* which are traditionally used for different purposes. Greater majority of the species have been reported to be used as food and medicine while 9 species have been reported to be used as food, 5 species as a medicine and 4 species have been reported to be used as both food and medicine. Fruits were reported to be frequently harvested parts used followed by leaves and tubers. This study revealed economic value of the *Solanum* species potential to sustain rural food and medicinal security.

INTRODUCTION

Herbal remedies were the first medicines used by the humans due to many pharmacologically active secondary metabolites produced by the plants. These medications are commonly used in all

medical settings to make its essential for primary care. Understanding how herbal medicines are sourced processed and standardized which can help the providers guide patient who are trying to choose the most clinically effective and affordable treatments. *Tinospora Cardifolia*, also known as Guduchi or Giloy (1). *Solanum* is a large family

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belonging to solanaceae which consist of 102 genera and over more than 2500 species of trees, shrubs and herbs. Plants in this family has variety of phytochemical like alkaloids, flavonoids, tannins, etc. The alkaloids are therapeutically the most powerful known anticholinergics in existence, meaning they hinder with the neurological signals transmitted by the endogenous neurotransmitter, acetylcholine (26). Plants like *Solanum aculeastrum*, *Solanum sandwicense*, *Solanum torvum*, *Solanum quadriloculatum* have great medicinal properties which helps to treat the disease and show various therapeutical properties. These plants have phytochemical which show different pharmacological properties like, antioxidants, antibacterial, antimicrobial, anticancer, antifungal and more (27). Plants have been utilized for restorative purposes from 5000 BC with the rise of the Indus Valley Development. The native arrangement of medication, viz.- Ayurvedic, Siddha and Unani, have been in presence for a very long time (2). *Solanum aculeastrum* Dunal (Solanaceae), known as “goat bitter-apple,” is a native of Africa and widely distributed in South Africa, mainly in Limpopo, Mpumalanga, KwaZulu-Natal, Western and Eastern Cape. *Solanum sandwicense* is a shrub which is a rare

species of flowering plant in the nightshade family known by the common names Hawai'i horsenettle. *Solanum torvum* commonly known as Turkey berry, this plant is originated from central South America, now this plant spread worldwide all over the tropics. *Solanum quadriloculatum* is known under the (ambiguous) common names of "bush tomato" or (in Australia) "wild tomato". In this review article we discuss 4 different solanum species plants, their medicinal use its phytochemical and also pharmacological properties of these plants. Many species of solanum are used as medicinal and therapeutic purpose throughout the country as a source of food and spice also as medicine.

Solanum Aculeastrum

Solanum aculeastrum is a shrub or small tree which is also known as soda apple or soda apple nightshade, poison apple. It is a poisonous nightshade species from Africa. This shrub reached 1-5 m in height with numerous sharp, hooked, brown thorns. This plant leaves are ovate and around 15 cm long and 13 cm broad. Flowering season for the plant is from September to July, peaking from November to March.



Figure 1: *Solanum aculeastrum*

Solanum aculeastrum contain various phytochemicals which includes flavonoids,

tannins, alkaloids, saponins, phenols, and terpenoids. All of these phytochemicals are

present in the methanolic extract of the plant and in aqueous extract only had flavonoids, alkaloids, saponins, and terpenoids (3). The fruits and leaves decoction of the plant is used to treat the cancer, indigestion and also in stomach disorders. The plant has Antibacterial, Anti-fungal, Anti-microbial and more (4). Extracts from the fruit are used topically to treat wounds and promote healing due to their antimicrobial properties. The plant contains compounds with antibacterial and antifungal activities, making it effective in managing infections. *S. aculeastrum* exhibits anti-inflammatory properties, often used for managing pain and swelling associated with conditions like arthritis. Studies suggest that its alkaloids and steroidal saponins may have anticancer activity, particularly against certain types of tumors. The plant is employed in traditional remedies for skin issues like rashes and eczema. The fruits are sometimes used as a purgative to detoxify the body, though care is needed due to their potential toxicity (13). The fruit pulp is applied topically for treating skin conditions like eczema, ringworm, and wounds. Decoctions of the leaves and fruits are consumed to relieve coughs, asthma, and other respiratory problems. The plant is used to treat infections caused by bacteria, fungi, and parasites,

including intestinal worms and schistosomiasis. Traditional healers prepare infusions to manage pain and inflammatory conditions such as arthritis. In some communities, extracts of the fruit are used to shrink tumors and are believed to have anticancer properties. It is employed in remedies for conditions like infertility and sexually transmitted infections. The plant is used in some areas to treat snakebites due to its believed detoxifying properties (17).

Solanum Sandwicense

Solanum sandwicense is a shrub which is a rare species of flowering plant in the nightshade family known by the common names Hawai'i horsenettle (5). The plant is around 5 meters tall and their stem in 15cm in diameter coated with yellow-brown hairs. The leaves of the plant is oval and measure up to 15 cm long by 14 wide. The flowers of *S. sandwicense* are perfect (having both male and female reproductive parts) that have bent peduncles so the flowers face downward. These actinomorphic (radially symmetrical) flowers have white erect filaments, yellow anthers, and a pale green stigma (6).



Figure 2: *Solanum sandwicense*

The species is extirpated from Hawaii. The last wild individual on Oahu died in the 1990s. Its seeds have been used to propagate more plants

which were then out planted in appropriate habitat. There are no more than 20 individuals remaining on Kauai. The plant is threatened by feral pigs,

feral goats, and mule deer. It is eaten by rats and slugs. The invasion of introduced species of plants such as *Kalanchoe pinnata* (air plant) and *Passiflora tarminiana* (banana poka) degrades the habitat (7). Parts of the plant have been traditionally used in herbal remedies for treating coughs, colds, and other respiratory issues. The plant's leaves and fruits are applied topically to aid in wound healing and skin conditions, leveraging its potential antimicrobial properties. The plant has been used to reduce inflammation in traditional Hawaiian medicine. As with many plants in traditional Hawaiian medicine, *S. sandwicense* was part of holistic healing practices, aiming to restore balance and health (14). Decoctions made from the leaves and fruits were used to alleviate

coughs, colds, and other respiratory ailments. Poultices made from crushed leaves were applied to wounds and skin irritations to promote healing and reduce inflammation. The plant was occasionally used to address digestive complaints, such as constipation or stomach aches. As part of traditional Hawaiian medicine, *S. sandwicense* was integrated into practices aiming to restore balance and well-being, often accompanied by prayers or rituals. Some parts of the plant were used ceremonially or as part of healing rites, emphasizing its role in both physical and spiritual health (18).

Solanum Torvum



Figure 3: *Solanum torvum*

Solanum torvum commonly known as Turkey berry, this plant is originated from central South America, now this plant spread worldwide all over the tropics. The plant cultivated in Africa and also in West Indies along with Asia. The fruits of this plant is also available in market as people use this fruit in various dishes like utilized as vegetable in most Africans and Indians market. This plant has various medicinal use as this plant use traditional medicinal plant in Africa and Asia to prevent and cure various disease. Various studies and research is conducted based on the plant fruits, seeds and leaves which reported to be effective against various disease like fever, wound healing, pain,

cough, liver problems, also use as antidote for some poisoning and also for reproductive problems, along with arterial hypertension and more. *S. torvum* properties include sedative, diuretic, hemostatic, haemopoietic, anti-microbial effects as well as free radicals scavenging thanks to its antioxidant effect. This plant has various phytoconstituents like alkaloids, flavonoids, saponins, tannins, and glycosides which shows pharmacological effects. *S. torvum* plant also have vitamins, essential organic nutrients (8). *S. torvum* has demonstrated significant antibacterial and antifungal activities, making it effective against various pathogens. It is often used to treat

infections and wounds. The plant is traditionally used to lower blood pressure, attributed to its bioactive compounds that exhibit vasodilatory effects. The fruit is rich in iron and is commonly used to improve hemoglobin levels in anemic individuals. Extracts of *S. torvum* have shown anti-inflammatory properties, beneficial in managing conditions like arthritis and other inflammatory disorders. The plant's fruits and leaves are rich in antioxidants, which help in scavenging free radicals and protecting against oxidative stress-related diseases. Traditional medicine uses the plant for its antidiabetic effects, as it helps regulate blood sugar levels. It is used to treat ulcers, stomach disorders, and diarrhea due to its antimicrobial and protective effects on the gastrointestinal tract (15). The fruit is a rich source of iron and is traditionally consumed to boost hemoglobin levels and combat anemia, particularly in postpartum women. Decoctions of the fruit or leaves are used to treat colds, coughs, and asthma, acting as an expectorant and soothing respiratory passage. The fruit is used to manage stomachaches, diarrhea, and intestinal worms. Its antimicrobial properties help in maintaining gut

health. Leaves and fruit extracts are applied externally or consumed to alleviate inflammation, swelling, and pain associated with arthritis and other conditions. Traditional healers recommend consuming the fruit for its potential to regulate blood sugar levels and manage diabetes. In some cultures, the plant is used to enhance fertility and treat reproductive issues in both men and women. The plant is believed to have vasodilatory properties and is used traditionally to lower blood pressure (19).

Solanum Quadriloculatum

Solanum quadriloculatum is known under the (ambiguous) common names of "bush tomato" or (in Australia) "wild tomato". It is a small fruiting shrub in the family Solanaceae. It was, and occasionally still is, included in *S. ellipticum* by some authors. Generally, these two species of "bush tomatoes" are currently considered distinct. It is native to Australia, where it is found primarily in shrubby eucalypt woodland and arid-zone shrublands (9).



Figure 4: *Solanum quadriloculatum*

Solanum quadriloculatum is an erect or sprawling shrub to 0.5 m high, grey-green or yellowish green; densely stellate-hairy, sometimes scabrous; prickles abundant on branches, petioles, peduncles

and calyces, sparse or absent elsewhere (10). Leaves ovate to elliptic, 5–9 cm long, 1.5–4 cm wide, margins entire and often slightly undulate; $\pm$ concolorous, $\pm$ grey-green, densely stellate-

pubescent; petiole 1–4 cm long (11). *Solanum quadriloculatum*, also known as wild tomato, contains tropane alkaloids, which can cause gastroenteric toxicity. Tropane alkaloids include atropine, scopolamine, hyoscyamine, and hyoscyne. Symptoms of tropane alkaloid poisoning include: Mydriasis, Dry mouth, apparent hallucinations, Ataxia, Hyperthermia, and Seizures in severe cases. If someone is poisoned by tropane alkaloids, they should be kept in a quiet, dark place. Diazepam or other benzodiazepine may be used for sedation, but opiates are contraindicated. Physostigmine may be helpful in severe cases (12). The plant's fruit and extracts are traditionally used in Aboriginal medicine for treating wounds and infections, likely due to its antimicrobial properties. Compounds in the plant exhibit anti-inflammatory effects, which are used to alleviate pain and swelling in traditional practices. Rich in phenolic compounds, *S. quadriloculatum* has potential antioxidant activity, aiding in the prevention of oxidative stress-related disorders. Preliminary research indicates that steroidal alkaloids in the plant may have cytotoxic effects on cancer cells, though further studies are needed to confirm this. In traditional medicine, the fruit is sometimes used for its mild laxative effects

and to treat digestive problems. Crushed fruit or extracts from the plant were applied to cuts, sores, and infections to promote healing and prevent microbial infections. The plant was used in remedies to alleviate pain and inflammation, likely due to its anti-inflammatory properties. Although primarily used as a food source, ripe fruits also served as a source of energy and nutrients during periods of scarcity, indirectly contributing to overall health. In traditional practices, the fruit was used to treat mild stomach disorders and as a gentle laxative. Preparations from the plant were applied to treat rashes, burns, and other skin irritations (20).

***Solanum Nigrum* Linn.**

The plant *solanum nigrum* linn. Commonly called as black night shade in English, makoi in hindi, kacchipandu in Telugu, munantakali in Tamil, piludi in Gujrati and kamuni in Marathi. It is an erect, divaricately branched, unarmed, suffrutescent annual herb. Leaves ovate or oblong, sinuate -toothed or lobed, glabrous; flowers 3-8 in extra- ancillary drooping sub umbellate cymes; fruits purplish black or reddish berries; seeds many, discoid, yellow.



Fig 5- *solanum nigrum*

The species is only cultivated in a few countries in Africa and Indonesia, and are largely utilized as a vegetable and fruit source through harvesting from

plants growing spontaneously as weed in cultivated fields, or in weedy plant communities, under trees, along fence and roads

, in shaded areas, near buildings and on waste land. They therefore constitute a volunteer crop. The berries and leaves are mainly used for medicinal purposes, besides the other parts of the whole plant. The leaves are used as poultice for rheumatic and gouty joints, skin diseases used in the treatment of anti-tuberculosis. Leaves are also used in dropsy, nausea and nervous disorders. The berries and flowers are useful for the cough. The juice of berries used as an antidiarrhea, and hydrophobia. It is also used in anasarca and heart disease. Berries are used to possess tonic, diuretic properties. The root is useful in otopathy, ophthalmopathy, rhino Pathy and hepatitis. The whole plant is used as antiseptic, anti-inflammatory, cardiogenic, digestive laxative, asthma etc. (21-25) Medicinal plants have been used since ancient time for the benefit and welfare of human beings, as time passed pharmaceutical industries started to use medicinal plants to manufacture herbal preparations based on established therapeutic efficacy explored from crude extracts or their essential oils. (28)

CONCLUSION

There are many important species in the genus *Solanum* belonging to the solanaceae family many of the underutilized *Solanum* species like *nigrum*, *tourvum*, *quadriloculatum*, *sandwicense* etc. the *Solanum* species promising source of bioactive compounds with potential for medicinal applications, including anti-inflammatory, antioxidant, anticancer, analgesic, antipyretic, antitumor, anti-oxidant, anti-microbial and insecticidal properties. These compounds have been shown to possess hepatoprotective, hypoglycaemic and cardiovascular activities. *Solanum* species contain various phytochemicals, including alkaloids, steroids, phenolic acid, flavonoids and saponins which exhibit diverse pharmacological activities. More research is

needed to fully explore the medicinal potential of *Solanum* species and to identify the specific compounds responsible for their therapeutic effects. With wide range of uses and an array of phytochemicals, *Solanum* can be a good source of pharmaceutical and nutritional agents. This review is an effort to compile information on botanical, phytochemical, ethno-botanical and nutritional uses and pharmacological activities of the *Solanum*. There is a need to explore pure chemical compounds responsible for the use of this plant in treating various diseases and to identify the nutritional components of this plant. Present review will provide an insight towards the new drug discovery.

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