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Some Wild Solanum Species as an Emerging Drug Sources

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Wild *Solanum* species represent one of the most promising and significant sources of potential pharmaceutical compounds. Solanum is one of the top ten genera rich in species of flowering plants, boasting around 1400 species present on all continents except for Antarctica. Despite its remarkable diversity, much of the genus remains underexplored, with many species still unknown or lacking comprehensive chemical characterization. Although a considerable number of phytochemical studies on the *Solanum* genus have been published, the chemical profiles and biological properties of numerous species are yet to be fully understood.

Various compounds identified within the *Solanum* genus have been linked to significant health-promoting activities, particularly in the fight against non-communicable diseases, which remain the leading cause of mortality worldwide. Several *Solanum* species have demonstrated a broad spectrum of pharmacological effects, including anthelmintic, hepatoprotective, antimalarial, and anticancer activities. The genus is particularly notable for its production of a diverse array of alkaloid compounds, which has led to its recognition as one of the most medicinally valuable plant groups.

To date, more than 100 distinct glycoalkaloids have been isolated from over 350 *Solanum* species. The genus also harbours various phytoconstituents that show promise as bio-insecticidal agents, capable of targeting vectors that spread diseases such as malaria, leishmaniasis, and dengue fever. The presence of these phytochemicals in different *Solanum* species indicates their potential as sources of effective adulticidal agents for disease control.
Phytochemicals derived from *Solanum* species hold immense promise for the development of therapeutic agents to treat a wide variety of illnesses. Among the key biologically active compounds found in this genus is solasodine, hyoscine, atropine, and anolide, which are widely used in the food and pharmaceutical industries. These wild species are also nutritionally valuable, possessing rich physicochemical properties that further enhance their potential as sources of health-promoting agents.

Solanum torvum

Solanum torvum is used in traditional medicine for the prevention and treatment of various ailments throughout Africa and Asia. The fruits, seeds, and vegetative parts of *S. torvum* have demonstrated efficacy in treating numerous conditions, including fever, cough, wounds, pain, liver disorders, dental decay, reproductive health issues, arterial hypertension, and poisoning, where it has been used as an antidote. This species also exhibits a range of pharmacological properties such as sedative, diuretic, hemostatic, hemopoietic, and antimicrobial activities. Additionally, its antioxidant potential contributes to the scavenging of free radicals. Phytochemical studies reveal that the fruits of *S. torvum* are rich in alkaloids, glycosides flavonoids, saponins and tannins, , which collectively account for its wide-ranging medicinal effects. The plant is also a source of essential vitamins, which are crucial for maintaining healthy metabolic processes in the human body.

Solanum khasianum

Solanum khasianum is a robust, woody shrub that grows to a height of approximately 0.75 to 1.5 meters. The plant features ovate to lobed leaves, both surfaces of which are covered in spines, as is its prickly stem. Its hermaphrodite flowers, which are white in color, grow in axillary clusters. The fruit is yellowish to greenish upon ripening, and the seeds are small, brown, and coated with sticky mucilage. Notable cultivated varieties of *S. khasianum* include Pusa-1, RRL 20-2, RRL-G, 'Arka Mahima,' and 'Arka Sanjeevini.' Being a hardy plant, *S. khasianum* can thrive across diverse soil types and agroclimatic zones, although it is intolerant to waterlogging conditions.

One of the most significant bioactive compounds produced by *S. khasianum* is solasodine, a glycoalkaloid that serves as a nitrogen analog of diosgenin. Solasodine is a precursor for synthesizing a variety of steroidal drugs, including anabolic steroids like testosterone and methyl testosterone, as well as corticosteroids such as hydrocortisone and prednisolone. These steroidal derivatives possess vital pharmacological properties, including anti-inflammatory, anabolic, and antifertility effects, which are extensively utilized in global health care and family planning initiatives.

Solanum gilo

Solanum gilo is a predominantly self-pollinating species, though cross-pollination can occur at rates of up to 30%. The species exhibits considerable variability in both intra- and interspecific traits, including differences in fruit shape, color, branching patterns, corolla diameter, petiole length, and leaf blade width. The fruit, characterized by a flattened round shape with grooved segments, typically measures 5–6 cm in length and 6–7 cm in width. The fruit stalk may be either straight or curved, and the seeds are notably small. Cultivation methods for *S. gilo* are similar to those of other *Solanum* species. The fruits, which possess a bitter taste, are rich in compounds associated with several health benefits.

Phytochemical analysis has linked the fruit's medicinal properties to the presence of bioactive substances such as dietary fiber, ascorbic acid, glycoalkaloids, phenolic compounds, α-chaconine, and anthocyanins. These compounds contribute to the species' wide-ranging pharmacological activities, including hypoglycemic, hypolipidemic, analgesic, anti-inflammatory, anti-asthmatic, and anti-glaucoma effects.

Solanum nigrum

It is also known as black nightshade or Makoi. This suffrutescent annual herb is characterized by its erect growth habit and widely spreading branches. The plant's ovate to oblong leaves are often sinuate-toothed or lobed. The flowers, which appear in extra-axillary, drooping sub-umbellate cymes, give rise to purplish or reddish berries. The seeds are numerous, yellow, and discoid in shape.

The berries and leaves are particularly valuable for medicinal use, though other parts of the plant are also utilized. The leaves are applied as poultices to skin diseases, relieve rheumatism and gout. It is also used in the treatment of nausea, dropsy, nervous disorders bronchitis, pulmonary tuberculosis, and diarrheal conditions. Decoctions made from the berries and flowers are effective in treating coughs and erysipelas.

Solanum muricatum

Solanum muricatum, commonly known as pepino, is native to the tropical and subtropical regions of the Andes. Although less widely known, the plant produces edible fruits that are juicy, fragrant, and mildly sweet. The fruits exhibit considerable variation in size, shape, and colour depending on the genotype. During the initial growth phases, the fruits contain minimal sucrose, but sucrose accumulation significantly increases as the fruit matures.

The fruit contains significant levels of phenolic compounds and flavonoids, which exhibit strong antioxidant, anti-inflammatory, and antimicrobial properties. It also contains alkaloids, glycoalkaloids, and saponins, known for their cholesterol-lowering, immune-boosting, and anticancer effects. Additionally, pepino is a good source of ascorbic acid

(vitamin C) and dietary fibre, which support overall health by enhancing immunity, aiding digestion, and regulating blood sugar levels. These combined phytochemicals make *S. muricatum* a promising functional food with potential applications in nutraceutical and pharmaceutical industries.

Summary

The wild relatives of brinjal, deeply embedded in the biodiversity of the Indian subcontinent, present an extraordinary repository of unique phytochemicals and bioactive compounds with exceptional therapeutic potential. Species such as *Solanum incanum*, *Solanum sisymbriifolium*, *Solanum torvum*, and *Solanum nigrum* have long been utilized in traditional medicinal systems, and modern scientific research is now validating these traditional uses by elucidating their rich phytochemical profiles and medicinal efficacy. These wild *Solanum* species are not only valuable for their pharmacological attributes but also hold significant potential for industrial and practical applications. Their rich nutraceutical profiles can be harnessed to develop improved plant varieties and high-quality products that address modern health challenges. As these species continue to be explored and understood, they offer immense opportunities for innovation in medicine, agriculture, and food security, ultimately contributing to the improvement of human health and well-being.