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An assessment of the medicinal potential of wild relatives of *Solanum* species

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Abstract

Brinjal's wild relatives from the Solanaceae family, indigenous to India, possess a remarkable therapeutic potential that has been largely unexplored. Since ancient times, brinjal has been valued for its culinary and medicinal properties. It is an important food crop. The primary differences between cultivars are found in the peel colour, fruit shape, size, and weight; nevertheless, other important factors that contribute to the origin of diversity and the acquisition of distinct morphological forms include chemical composition, early fruiting, and environmental challenges. The variety of brinjal fruits' form and biochemical composition play a significant role in determining whether fruit is preferred for human consumption or consumption by a specific species. *Solanum* species like *S. incanum*, *S. sisymbriifolium*, *S. torvum*, and *S. nigrum* are rich in bioactive compounds, exhibiting a wide range of pharmacological activities validated by traditional use and scientific studies. *S. incanum* shows antimicrobial, antioxidant, and neuroprotective effects; *S. sisymbriifolium* demonstrates analgesic, antidiarrheal, hypotensive, and cytotoxic properties; *S. torvum* exhibits antioxidant, anti-inflammatory, antimicrobial, and anticancer potential; and *S. nigrum* reveals antioxidant, anti-inflammatory, antibacterial, antifungal, antidiabetic, anticancer, and immunomodulatory qualities. This untapped reservoir of medicinal plants demands extensive research to unlock their full therapeutic potential for novel drug discovery.

1. Introduction

Humans have relied on natural resources like plants, animals, microorganisms, and marine life for medicinal purposes since ancient times, with evidence dating back approximately 60,000 years in fossil records (Shi *et al*., 2010; Fabricant and Farnsworth, 2001). Native midwives, herbalists, healers, and primarily women employed only herbal remedies and spices to cure a wide range of illnesses in the eighteenth century (Sameemabegum *et al*., 2022; Duraisami *et al*., 2021). Natural medications began to be gradually replaced by synthetic ones as time went on and medical science advanced (Nisar *et al*., 2018). In addition to curing illnesses, synthetic medications have serious negative effects on the human body. For example, while paracetamol is a well-known antipyretic, one of its main adverse effects is liver toxicity (Tanne, 2006) and gastrointestinal side effects are caused by naproxen (Alhammadi *et al*., 2022). Another antipyretic medication that induces nephrotoxicity and renal failure (Moghal *et al*., 2004) in children with low blood volume is ibuprofen. So, people are now moving back to phytomedicine.

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A significant portion of the daily diets of 60-70% of people living in agricultural and forested regions of developing nations are made up of the various plant parts and foods that are collected from the forest species, such as nuts, fruits, roots, and leaves (Vijayalakshmi *et al*., 2022; Aryal *et al*., 2009). There are around 9,500 relevant species for ethnobotany among the 45,000 species of wild plants. 7,500 of these species are used medicinally in native medical customs. Tribal people consume over 3,900 different plant species, of which 145 are edible roots and tubers and 521 are green vegetables (Kamble and Jadhav, 2013). The COVID-19 pandemic has prompted a shift towards healthier lifestyles, with a focus on incorporating immune-boosting medicinal plants and wild fruits like bael, aonla, and jamun into diets. These natural sources are rich in bioactive compounds such as polyphenolics and flavonoids, offering potential health benefits and bolstering immunity against various diseases, including COVID-19 (Bhatt *et al*., 2021).

Plants in the Solanaceae family are frequently consumed. The *Solanum* genus, which is among the most extensive plant families, encompasses a wide array of edible species, including well-known examples such as potatoes (*S. tuberosum*), tomatoes (*S. lycopersicum*), and brinjals (*S. melongena*). Due to the variety of phenolic, alkaloid, saponin, terpene, and lipid chemicals found in the *Solanum* genus, it has been widely employed in medicine. Numerous alkaloids belonging to the *Solanum* genus have shown promising results in terms of their antirheumatic, antibacterial, antioxidant, and antitumor properties, with the latter being able to combat multiple forms of cancer (Nkwe *et al.,* 2001). In the Solanaceae family, wild relatives often possess greater medicinal value. Brinjal, native to India, has numerous wild plant relatives distributed across the country. These wild plants, closely associated with brinjal, grow naturally throughout India, contributing to the rich biodiversity of the region and offering a wealth of medicinal properties. In this review, the medicinal properties of these wild relatives will be explored, shedding light on their potential as valuable resources for natural remedies and innovative healthcare solutions, aiming to pave the way for further research and discovery in the field of medicinal botany.

2. Brinjal's wild relatives

Crop wild relatives (CWRs) are invaluable resources, comprising wild plant species closely related to cultivated crops, sharing genetic traits, and offering a rich reservoir of genetic diversity. These wild relatives hold immense potential for enhancing the resilience, productivity, and adaptability of cultivated crops, especially in the face of environmental challenges like climate change, pests, and diseases. Among these CWR's, wild plants closely related to brinjal stand out for their remarkable medicinal value compared to others. Species such as *S. sisymbriifolium, S. torvum, S. nigrum, S. incanum, S. anguivi, S. violaceum,* and *S. linnaeanum* have been identified as potent brinjal wild relatives. These plants, distributed across diverse habitats, possess unique phytochemical profiles and bioactive compounds, making them promising candidates for medicinal applications.

Table 1: Botanical description of Brinjal's wild relatives (Knapp *et al*., 2013; Frodin, 2004)

Botanical name	Botanical description
S. insanum	A perennial herbaceous plant with a sprawling or climbing growth habit. It bears star-shaped flowers and small, tomato-like berries and is often found in disturbed habitats across Asia, Africa, and Australia.
S. anguivi	A wild species with small, round fruits and spiny stems, native to Africa, is known for its tolerance to drought conditions.
S. campylacanthum	Also known as the African eggplant, this species has yellow-orange fruits and is used in traditional medicine in Africa.
S. dasyphyllum	A wild species with small, white flowers and hairy leaves, found in Africa and Asia.
S. incanum	Commonly known as the thorn apple, this species has small, round fruits and is considered a weed in many regions.
S. lichtensteinii	A wild species found in Africa with small, purple fruits and spiny stems.
S. linnaeanum	Native to Africa, this species has white or purple flowers and small, round fruits.
S. tomentosum	Also known as the woolly nightshade, this species has hairy leaves and stems with purple flowers and small, round fruits.
S. lidii	A wild species with purple flowers and small, round fruits is found in Africa.
S. pyracanthos	Commonly known as the porcupine tomato, this species has spiny stems and red-orange fruits and is native to Africa.
S. vespertilio	Also known as the bat-winged brinjal, this species has purple flowers and large, wing-shaped leaves and is found in Africa.
S. violaceum	Native to Africa, this species has purple flowers and small, round fruits, often used in traditional medicine.
S. sisymbriifolium	Also known as the sticky nightshade, this species has white or purple flowers and prickly stems and is native to South America.
S. torvum	Also known as turkey berry, this species has small, green fruits and is used in various culinary dishes, particularly in South Asia and Africa.
S. nigrum	Also known as black nightshade, this species has small, black berries and is found in many regions worldwide.

S. insanum ***S. anguivi*** ***S. campylacanthum*** ***S. dasyphyllum*** ***S. incanum***

Figure 1: Brinjal wild relatives.

3. Pharmacological potential of *Solanum* species

Plant resources have been the source of many bioactive compounds currently in use, either as isolated entities or as derivatives (Cowan, 1999). These indigenous botanical cousins, thriving in diverse ecosystems, possess unique biochemical compositions and genetic diversity, making them valuable resources for traditional medicine and modern pharmacology alike. From remote forests to rural farmlands, these wild relatives have been revered for generations by indigenous communities for their healing properties, addressing a wide array of health ailments.

3.1 *Solanum sisymbriifolium*

S. sisymbriifolium (Solanaceae), commonly known as sticky nightshade, has a rich history of traditional medicinal use, including treating hysteria, fever, stomachaches, diarrhea, respiratory infections, and central nervous system abnormalities (Ibarrola *et al.,* 2006; Ferro *et al.,* 2005). Pharmacological studies have highlighted various therapeutic properties of its components, such as antidiarrheal, analgesic, hypotensive, and neuropharmacological effects. Research on *S. sisymbriifolium*'s aerial parts has revealed significant phytochemical diversity and robust antimicrobial activity (Gupta *et al.,* 2014). Studies on its leaf extract demonstrated potent analgesic, neuropharmacological, antidiarrheal, and cytotoxic effects, with notable cytotoxicity against brine shrimp (Apu *et al.,* 2013a). Furthermore, the crude hydroalcoholic extract from *S. sisymbriifolium* root exhibited significant dose-dependent hypotensive effects in hypertensive rats, although it had no significant impact on blood pressure in conscious normotensive rats when administered orally (Ibarrola *et al.,* 1996). Additionally, the ethanol extract of *S. sisymbriifolium* fruits displayed significant analgesic effects, anxiolytic behavior, and suppression of locomotor activity in mice, alongwith highly significant antidiarrheal activity in a dose-dependent manner (Apu *et al.,* 2013b). Investigations into the phytochemical and pharmacological properties of ripe and unripe fruits of *S. sisymbriifolium* revealed higher antioxidant activity and phenolic content in ripe fruits, indicating potential nutritional and medicinal significance. The root of *S. sisymbriifolium*, traditionally used in Paraguay, demonstrates hypotensive effects in rats, with nuatigenosido identified from the extract showing potential pharmacological actions, including blood pressure reduction and modulation of cardiac function in frog models (Ibarrola *et al.,* 2006).

Table 2: Compounds isolated from *S. sisymbriifolium*

Compound class	Specific compounds	References
Steroidal saponins	Isonuatigenin-3-O-β-solatriose, nuatigenin-3-O-β-chacotriose	Ferro *et al.*, 2005
Glycoalkaloids	Solacaproýne, solanine, solasodine	Chand *et al.*, 1995; Ferro *et al.*, 2005; Chauhan *et al.*, 2011
Steroidal alkaloids	Solamargine, β-solamarine	Bagalwa *et al.*,2010
Pyrrolidine alkaloids	Cuscohygrine	Alonso, 2004
Lignans	Sisymbrifolin	Chakravarty *et al.*, 1996
Sterols	Campesterol	Chakravarty *et al.*, 1996
Steroid glycosides	Cilistol A, cilistadiol	Niero *et al.*, 2006
Spirostane saponin	Nuatigenosido	Ibarrola *et al.*, 2006
Lignans	Neolignan	Ibarrola *et al.*, 2006

3.2 *Solanum torvum*

The small solanaceous shrub *S. torvum* is widely distributed throughout tropical America, the Philippines, Malaya, China, Pakistan, and India. Different cultural communities have employed the dried stem and root of this plant for centuries to address a range of health conditions. Investigations into *S. torvum* phytochemical profile, antimicrobial efficacy, and antioxidant potential have revealed various bioactive compounds and dose-dependent antibacterial and antioxidant activities (Kannan *et al*., 2012). Furthermore, *S. torvum*, a staple in Cameroonian traditional medicine for pain and inflammation management, has exhibited analgesic and anti-inflammatory properties in aqueous leaf extracts, attenuating acetic acid- and pressure-induced pains and inhibiting carrageenan-induced inflammation (Ndebia *et al*., 2007). The methanolic extract of *S. torvum* leaves displayed phytochemical constituents and antimicrobial activity against bacterial strains, with minimum inhibitory concentrations ranging from 2.5 to 5.0 mg/ml (Brobbey *et al*., 2016).

A chemical substance called methyl caffeate was extracted from the fruit of *S. torvum*. The antidiabetic potential of this molecule was assessed at 10, 20, and 40 mg/kg. In streptozotocin-induced diabetic rats, methyl caffeate significantly increased blood sugar levels through dose-dependent upregulation of GLUT4 and pancreatic β-cell regeneration (Gandhi *et al.,* 2011a). A concentration of *S. torvum* extract yielded an antioxidant activity index equivalent to 3.68 mg of trolox and 360.53 mg of ascorbic acid per gram. In relation to lipid peroxidation and superoxide anion activity, *S. torvum* is recognized as a substantial reservoir of phenolic and flavonoid content, which possess the capacity to neutralize free radicals and hinder the activity of the CYP2E1 enzyme (Kusirisin *et al.,* 2009). Phenolic compounds found in the 200 and 400 mg/kg methanolic extract of *S. torvum* fruit have been observed to reduce blood glucose levels in streptozotocin-induced rats with diabetes. Additionally, they have been observed to lessen oxidative stress, modify the enzymes involved in glucose metabolism, and increase insulin production as a result of β-cell regeneration (Gandhi *et al.,* 2011b).

The ethanolic extract of *S. torvum* exhibited significant cytotoxic effects on Ehrlich's Ascites Carcinoma cell lines, highlighting its potential as a promising anticancer agent (Panigrahi *et al.,* 2014). Compounds extracted from the aqueous extract of unripe *S. torvum* fruits, identified *via* GC-MS analysis, were evaluated for their potential in treating breast cancer through molecular docking studies using PyRx software. These compounds demonstrated promising binding affinity, with ergost-25-ene-3,6-dione,5,12-dihydroxy showing superior efficacy compared to the synthetic drug doxorubicin (Saravanan *et al.,* 2022). Methyl caffeate from *S. torvum* fruit exhibited potent anticancer effects on MCF-7 cells by inducing apoptosis via caspase activation and cytochrome c release. Molecular docking studies confirmed stable binding to key apoptosis-regulating proteins, suggesting therapeutic potential against breast cancer (Balachandran *et al.,* 2015).

Table 3: Compounds isolated from different parts of *S. torvum*

Plant part	Compounds isolated	References
Fruit	Antiviraliso flavonoid sulfate (torvanolA), steroidal glycosides (torvoside H, torvoside A)	Arthan *et al.,* 2002
Aerial parts	Steroidal compounds (solanolide 6-O-[α-L-rhamnopyranosyl-(1 → 3)-O-β-D-quinovo pyranoside], solanolide 6-O-[â-D-xylopyranosyl-(1 → 3)-O-β-D-quinovopyranoside], yamogenin 3-O-[β-D-glucopyranosyl-(1 → 6)-O-β-D-glucopyranoside], solanolide 6-O-[α-L-rhamnopyranosyl-(1 → 3)-O-β-D-quinovopyranoside]), Two novel C-22 steroidal lactone saponins (solanolactosides A, B), Two new spirostanol glycosides (torvosides M, N)	Lu *et al.,* 2009; Yuan-Yuan *et al.,* 2011
Leaves	Torvanol A, Neochlorogenin 6-O-β-D-quinovopyranoside, neochlorogenin 6-O-β-D-xylo-pyranosyl-(1 → 3)-β-D-quinovopyranoside, neochlorogenin 6-O-α-L-rhamnopyranosyl-(1 → 3)-β-D-quinovopyranoside, solagenin 6-O-β-D-quinovopyranoside, solagenin 6-O-α-L-rhamnopyranosyl-(1 → 3)-β-D-quinovopyranoside, isoquercetin, rutin, kaemp-ferol, quercetin, Furostanol glycoside 26-O-beta-glucosidase, 3,4-trimethyl triacontane, octacosanyltriacontanoate, 5-hexatriacontanone, triacontanol, 3-tritriacontanone, tetratriacontanoic acid, sitosterol, stigmasterol, campesterol	Yuan-Yuan *et al.,* 2011

3.3 *Solanum nigrum*

S. nigrum, popularly known as black nightshade, is a native medicinal plant that has been employed in traditional medicine for generations. Phytochemical studies have revealed the presence of various bioactive compounds in *S. nigrum*, including alkaloids, flavonoids, steroids, and saponins (Tai *et al.,* 2018; Ding *et al., 2013*; Zhou *et al.,* 2006). Traditionally, *S. nigrum* has been widely utilised to address a range of ailments, including pain, inflammation, and fever (Acharya and Pokhel, 2006). In oriental medicine systems, the plant is employed for multiple purposes, serving as an antitumorigenic and antioxidant (Lee and Lim, 2003), anti-inflammatory (Zakaria *et al.,* 2006), hepatoprotective (Raju *et al.,* 2003), diuretic (Zakaria *et al.,* 2006), and antipyretic agent (Zakaria *et al.,* 2006). Specifically, studies conducted on animals and cell cultures indicate that *S. nigrum* extracts inhibit cancer cell proliferation, mitigate chemically induced organ damage, modulate immune responses, and offer defence against oxidative stress (Ji *et al.,* 2008; Lee *et al.,* 2004; Li *et al., 2009*; Akula and Odhav, 2008; Heo and Lim, 2004; Ravi *et al.,* 2009; Bhatia *et al.,* 2011; Chou *et al.,* 2008; El-Hawary *et al.,* 2016; Kavishankar *et al.,* 2011; Javed *et al.,* 2011).

Traditionally, *S. nigrum* has been employed for preventing symptoms such as discomfort, inflammation, infections, and gastrointestinal tract issues (Moshi *et al.,* 2009; Javed *et al.,* 2019). While preliminary research suggests that *S. nigrum* has therapeutic potential, more phytochemical, toxicological, and epidemiological investigations are needed to fully characterize its efficacy, safety, bioactive components, mechanisms of action, and transpose folk practices into scientifically supported medicinal applications. *S. nigrum* extract exhibits potent anti-tumor effects against C6 glioma both *in vitro* and *in vivo*, offering a promising therapeutic avenue for treating high-grade gliomas (Li *et al.,* 2021).

Table 4: Compounds present in *S. nigrum*

Plant part	Compound class	Compounds	References
Whole plant, fruits, berries	Glycoalkaloids	Solanine, solamargine, solasodine	Tai *et al.,* 2018; Ding *et al.,* 2013
Whole plant	Saponins	Nigrumnins I & II, solanigrosides	Zhou *et al.,* 2006; Ikeda *et al.,* 2000
Whole plant	Glycoproteins	150 kDa glycoprotein	Lee and Lim, 2003
Leaves	Flavonoids	Narigenin, rutin, catechin, epicatechin	Chou *et al.,* 2008
Leaves	Phenolic Acids	Cinnamic acid, p-coumaric acid, carnosic acid	Chou *et al.,* 2008

3.4 *Solanum incanum*

One species that is traditionally used in many Ethiopian villages is *S. incanum*. It features blue blooms with yellow pistils, yellow fruits, and prickly leaves (Abebe *et al.,* 2014). *S. incanum* is frequently observed near homes, wastelands, roadsides, and overgrazed grasslands. Numerous categories of phytochemicals, such as xanthenes, flavonoids, terpenoids, and various metabolites like tannins, saponins, cyanates, oxalate, and anthraquinones, have been reported to be contained in the fruits of *S. incanum* (Asaolu, 2003). Additionally, it was observed that steroid glycosides were present in the form of glycoalkaloids like solanine and solasonine (Alghamdi, 2013). *S. incanum* leaves are abundant in minerals, including K (Auta and Ali, 2011) and Ca (Abdalla, 2015). *S. incanum* extracts exhibit significant antibacterial activity against *Escherichia coli* and *Staphylococcus aureus*, validating their traditional use in ethnomedicine and highlighting their potential for treating infections caused by these bacteria (Musyimi *et al.*, 2021). *S. incanum* extracts from *Burkina Faso* exhibit potent antibacterial properties, particularly the hydroacetone extract rich in phenolic compounds, offering promising potential for cost-effective phytotherapy against poultry microbial diseases like pasteurellosis (Sere *et al.*, 2022). *S. incanum*, known for its traditional medicinal use, offers promising antimicrobial properties against food-poisoning bacteria such as *Staphylococcus aureus, Escherichia coli,* and *Salmonella typhimurium.* Root and fruit extracts exhibit notable antibacterial activity, with the root extract showing greater efficacy. This suggests a potential role for *S. incanum* extracts in combating foodborne illnesses as alternative antimicrobial agents (Kilonzo *et al.*, 2020).

Assessing the effects of *S. incanum* on heart and haematological parameters in wistar rats with copper toxicity, the study found copper-induced anaemia, partially alleviated by *S. incanum* treatment but leading to polycythemia when consumed alone (Hassan *et al.*, 2022a). The investigation explored the effects of *S. incanum* methanolic leaf extract on antioxidant, anti-cholinesterase activity, and dopamine levels in arsenic-induced neurodegeneration. Results revealed significant reductions in CAT and SOD activities and cholinesterase levels in arsenic-exposed groups, mitigated by *S. incanum* treatment. Histopathological findings indicated neurocyte degeneration, suggesting *S. incanum* potential as a remedy against arsenic poisoning due to its antioxidant and neuroprotective properties (Hassan *et al.*, 2022b). *S. incanum* root decoction exhibits promising antidiabetic potential in mice, demonstrating significant hypoglycemic and antihyperlipidemic effects, validating its traditional use in Ethiopian remedies for diabetes (Andargie *et al.*, 2022).

Table 5: Compounds present in *S. incanum*

Compound class	References
Xanthenes, flavonoids, terpenoids, tannins, saponins, cyanates, oxalates, anthraquinones, steroid glycosides, potassium (K), calcium (Ca), phenolic compounds	Asaolu, 2003; Alghamdi, 2013; Auta and Ali, 2011; Abdalla, 2015; Sere *et al.,* 2022

3.5 *Solanum anguivi*

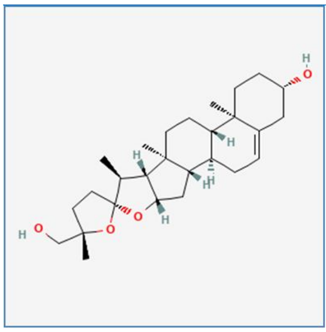
The ethnomedical plant *S. anguivi* is indigenous to Africa and is probably present throughout all of the continent's non-arid tropical areas. Its existence in Asia and Australia is also suggested by reports. Although its natural habitat is the wild, it is sometimes produced as a semi-cultivated vegetable in areas such as Uganda and the Ivory Coast. The plant's fruits and leaves are harvested and eaten as vegetables. *S. anguivi* fruit saponin shows brain-specific antioxidant effects, preserving mitochondrial function and mitigating oxidative damage, indicating potential for treating neurodegenerative diseases (Elekofehinti *et al.,* 2015). Elekofehinti *et al.*, 2012 investigated the antioxidant properties and ability to inhibit Ca^{2+}-induced mitochondrial swelling of African eggplant (*S. anguivi*) fruit, which is rich in bioactive polyphenolic compounds. Their findings suggest potential health benefits associated with consuming this fruit. The extracts also showed stronger bactericidal effects on Gram-positive bacteria compared to Gram-negative bacteria (Tegegne *et al.,* 2021).

3.6 *Solanum linnaeanum*

S. linnaeanum, also known as 'Bringelleangive' in Mauritius, is a vegetable belonging to the Solanaceae family. Aside from its culinary purposes, *S. linnaeanum* is traditionally employed as a natural remedy for diabetes, aiding in the control of blood glucose levels. Evaluation of *S. linnaeanum* extracts revealed potent antioxidant and antidiabetic properties. *S. linnaeanum* decoction and methanol extract displayed notable pancreatic lipase inhibition and antioxidant activity. Phytochemical analysis identified phenols and flavonoids in the methanol extract (Mahomoodally and Ramcharun, 2015). *S. linnaeanum* demonstrated potent antimicrobial activity, particularly against *Listeria monocytogenes*, exhibiting a concentration-dependent effect. This highlights its potential as a natural remedy against this bacterial strain, suggesting further exploration for therapeutic applications. Glycoalkaloids from *S. linnaeanum* berries were isolated *via* column chromatography and confirmed using NMR spectroscopy and MS/MS spectrometry. The process yielded solasonine (37.1 mg), a solasonine and solamargine mix (92.3 mg), and solamargine (56.2 mg) from 81.67 g of dried berries. This efficient protocol demonstrates that the berries are rich sources of glycoalkaloids (Gurbuz *et al.,* 2015).

Table 6: Compounds present in *S. anguivi*

Compound class	Specific compounds	Potential curative measures	References
Saponins	Triterpenoid saponins, steroidal saponins/glycosides (anguiviosides A-C, III, XI, XV, XVI)	Antidiabetic, antioxidant, antihyperlipidemic, regeneration of pancreatic β-cells	Elekofehinti *et al.,* 2013a; Elekofehinti *et al.,* 2013b; Elekofehinti *et al.,* 2012
Phenolics	Gallic acid, chlorogenic acid, caffeic acid, phenolic acids, tannins	Antidiabetic, antioxidant, inhibition of α-amylase and α-glucosidase, increased glucose uptake, improved lipid profile, stimulation of GLP-1 secretion	Elekofehinti *et al.,* 2013c; Alegbe *et al.,* 2019; Domínguez Avila *et al.,* 2017; Jokura *et al.,* 2015
Flavonoids	Rutin, quercetin	Antidiabetic, antioxidant, regeneration of pancreatic β-cells, increased glucose uptake	Eid *et al.,* 2010
Alkaloids	Solamargine, anguivine, isoanguivine (steroidal glycoalkaloids)	Antidiabetic, inhibition of α-amylase and α-glucosidase, increased glucose uptake, antioxidant	Al-Ashaal *et al.,* 2018; Agrawal *et al.,* 2013; Kang *et al.,* 2015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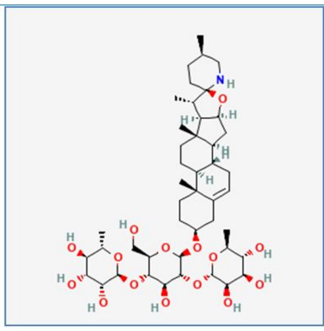
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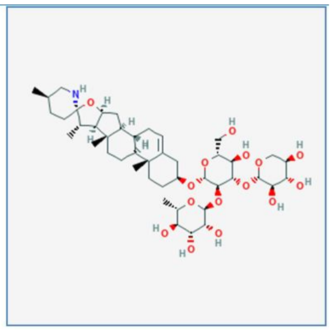
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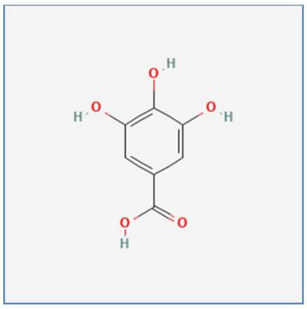
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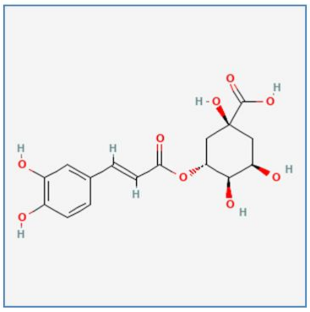
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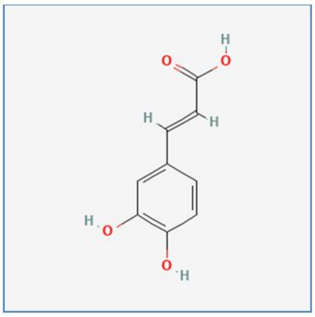
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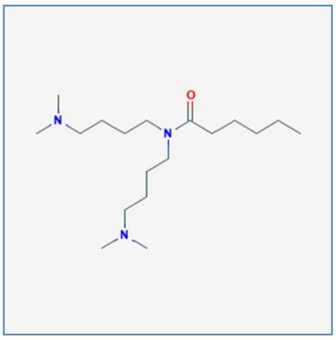
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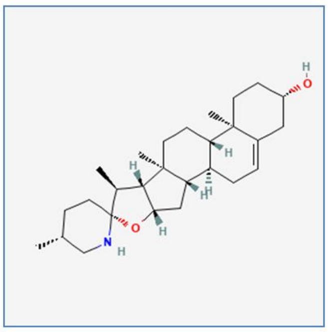
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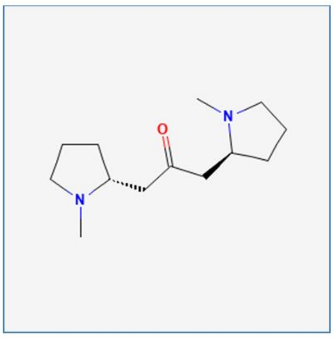
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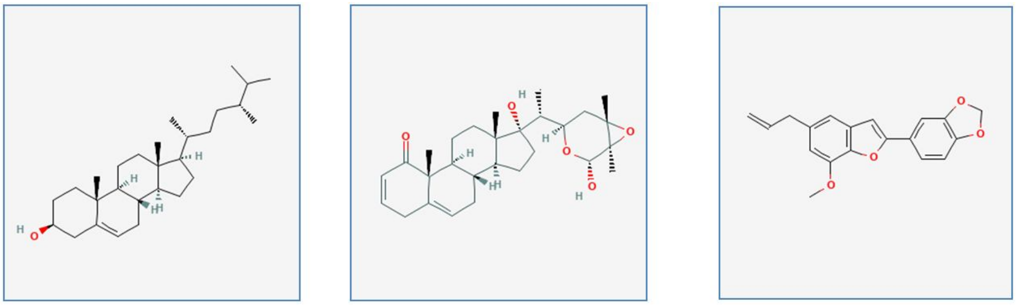

Campesterol   Cilistol A   Neolignan

Figure 2: Some of the potential compound's structure from *Solanum* species.

3.7 *Solanum campylacanthum*

S. campylacanthum, also known as the African eggplant, is a plant species native to Africa, cultivated in several African countries for its edible fruits. It has been reported to have antifungal properties, making it a potential treatment for ringworms. Kipngeno *et al.* (2014) found that *S. campylacanthum* exhibits antifungal activity, supporting its traditional use in the treatment of ringworms. However, herbalists advise pregnant mothers against using *S. campylacanthum* infusions for stomach problems, as they may induce abortion. Despite this caution, the plant is believed to play significant roles during labor and in maintaining pregnancy (Kaingu *et al.,* 2013).

3.8 *Solanum dasyphyllum*

S. dasyphyllum, a plant widely used in traditional medicine and food for its therapeutic properties, has been extensively studied. Oyinloye *et al*. (2021) extracted dried leaves of *S. dasyphyllum* using a Soxhlet apparatus with 80% methanol, followed by various analyses including phytochemical screening, antimicrobial testing, antioxidant activity assay, and GC-MS analysis. Their findings suggest that the leaf extract of *S. dasyphyllum* may be safe at lower doses but could be toxic at higher doses over an extended period of time (Oyinloye *et al.,* 2021). Additionally, the extract was found to contain various phytochemicals such as flavonoids, alkaloids, saponins, cyanogenic glycosides, tannins, and reducing sugars, which contribute to its antimicrobial and antioxidant properties (Oyinloye *et al.,* 2023; Sodeinde *et al*., 2019).

3.9 Antinutritional compounds

Alkaloids are bitter components of plants that are synthesised by plants from amino acids. Alkaloids are nitrogen-containing compounds acting as secondary plant metabolites able to form salts with acids such as oxalic, malic, tartaric, or citric acid (Lo *et al*., 2004). Alkaloids have been isolated from the roots, seeds, leaves, or bark of some members of a minimum 40% of plant families. Families that are particularly rich in alkaloids include Solanaceae. Alkaloids such as calystegines, nicotine, capsaicinoids, and myosmine are found in the Solanaceae family (Sahu *et al*., 2020). Calystegines is the second-highest amount of alkaloid found in the Solanaceae family. Alkaloids are premeditated to be antinutrients due to their effect on the nervous system, hindering or erroneously enhancing electrochemical transmission. The glycoalkaloids solanine and chaconine found in potato and *Solanum* spp. are hemolytically active and harmful to fungi and humans. There have been studies on the infertility effects of certain plant alkaloids, although less intake of alkaloids arbitrates pivotal therapeutic functions such as pain reduction, blood pressure control, tumour cell destruction, and stimulation of circulation and respiration (Sinha and Khare, 2017).

4. Conclusion

These brinjal's wild relatives species, deeply rooted in the Indian subcontinent, offer a treasure trove of unique phytochemicals and bioactive compounds with remarkable therapeutic properties. From antimicrobial and antioxidant activities to anti-inflammatory, anticancer, and neuroprotective effects, these wild cousins of the beloved brinjal demonstrate a diverse array of pharmacological actions. Species like *S. incanum, S. sisymbriifolium, S. torvum,* and *S. nigrum* have been revered in traditional medicine for generations, and scientific studies are now validating their efficacy and unveiling their phytochemical richness. However, much remains to be explored and understood regarding the intricate mechanisms of action, optimal dosages, and potential synergistic effects of these natural remedies. This review serves as a catalyst for further research and exploration into the medicinal bounty offered by brinjal's wild relatives. By harnessing the power of these plants through rigorous scientific investigation, we can pave the way for the development of novel therapeutic agents, complementing and potentially enhancing our existing arsenal of pharmaceuticals.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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