

Potential of *Solanum xanthocarpum* as a Source of Natural Therapeutic Agents : A Review

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Abstract: *Solanum xanthocarpum* (Indian nightshade or Kantakari) is an important herb in Ayurveda, widely used for respiratory, liver, and inflammatory problems. The plant contains many active compounds, especially steroidal alkaloids like solasodine and solasonine, along with phenolics and triterpenes. These chemicals are responsible for its antioxidant, antimicrobial, hepatoprotective, immunomodulatory, bronchodilator, antifertility, and antidiabetic effects. This review brings together updated information on its chemical composition and medicinal uses, showing its potential for new herbal medicines and useful bioactive compounds. More research can help convert traditional knowledge into effective modern therapies for human health.

Keywords: *Solanum xanthocarpum*, Pharmacological Significance, solasodine, Herbal formulations.

Introduction - With the increasing concerns over the adverse effects of synthetic drugs and chemical-based therapies, there has been an increasing global interest in exploring ethnomedicinal plants for the prevention and treatment of various health disorders. For centuries, tribal communities and rural populations have relied on local medicinal plants as a primary source of healthcare. Among these valuable medicinal resources, *Solanum xanthocarpum* Schrad. & Wendl. (Family: Solanaceae) commonly called as Indians nightshade or kantkari, occupies a prominent position due to its wide range of therapeutic applications

Solanum xanthocarpum Schrad. & Wendl (Solanaceae) is annual herb and is found throughout India at every soil, mainly grows as a wild plant rising along the dry wastelands and way sides in different parts in India. It is also referred as Kantakari or Bhatkatiya in the vernacular language. Berries are yellow or in the white green striation and they are covered by expanded calyx. Berries are edible and the many tribal people in India use them as folk medicines.

Taxonomical Classification: *Solanum xanthocarpum* (Schrad. & Wendl.), belonging to the family Solanaceae, is widely distributed in tropical and subtropical regions of Asia and Australia. In India, it grows abundantly in Uttar Pradesh, West Bengal, Assam, Bihar, Punjab, and Karnataka (Mysore region). Beyond India, its natural occurrence has been reported in Sri Lanka, Malaysia, Malacca, Southeast Asia, tropical Australia, and Polynesia (Fathima et al., 2019).

Classification:

- i. **Kingdom:** Plantae
- ii. **Division:** Magnoliophyta
- iii. **Class:** Magnoliopsida
- iv. **Subclass:** Asteridae
- v. **Order:** Solanales
- vi. **Family:** Solanaceae
- vii. **Genus:** *Solanum*
- viii. **Species:** *Solanum xanthocarpum*
- ix. **Binomial name:** *Solanum xanthocarpum* Schrad and Wendl.
- x. **Synonym:** *Solanum surattense* Burm.

Botanical Description: Small, prickly, perennial, and diffusely bright green herb, *Solanum xanthocarpum* usually reaches a height of two to three meters. There are many strong yellow prickles on the zigzag stems (~1.3 cm). The leaves are elliptic to oval (2.5–5.7 cm), have yellow spines along the midrib, and are covered in stellate hairs. The calyx, which is roughly 1.3 cm long, is heavily coated in tiny, delicate hairs. At the base, it takes the shape of a short tubular structure that is rounded and globular. The tiny, violet flowers have oblong anthers (~8 mm) and linear, hairy lobes. Bound by the inflated calyx, the fruits are globular berries (1.3–2 cm) that are green with white lines while young and turn yellow during ripening. The seeds are glabrous, smooth, yellowish, and 2.5 mm in diameter.

Solanum xanthocarpum has been used in Ayurveda for centuries, three varieties of this plant are recognized, distinguished by their violet, yellow, and white flowers (Rita & Animesh, 2011). In traditional medicine, it has been used for many health problems. This review brings together the traditional knowledge of the plant's healing properties and

highlights the need for further research to develop effective medicines.



Figure 1 (a) & (b): *Solanum xanthocarpum* Schrad and Wendl. (Kantkari)

Phytochemical Constituents: The main alkaloid found in *Solanum xanthocarpum* is **solasodine**, which is present in almost every part of the plant, including its fruits, leaves, and seeds (Arora & Ansari, 2019). Besides this, the plant contains several other important bioactive compounds. These include steroidal alkaloids such as solanacarpine, solanacarpidine, solasonine, and solamargine; phenolic compounds like caffeic acid, aesculetin, and aesculin; steroidal compounds such as carpesterol, diosgenin, campesterol, and daucosterol; and triterpenes like cycloartenol (Paul & Bhutani, 2008). These natural compounds show medicinal effects such as antioxidant, anti-inflammatory, antimicrobial, liver-protective, larvicidal, and blood sugar-lowering activities (Tupkari et al., 1972; Sato & Latham, 1953).

Ethanobotanical Relevance : Different communities across India use *Solanum xanthocarpum* in unique ways as part of their traditional practices. In Odisha, the Kondh tribes prepare a fruit decoction to help manage diabetes (Imran, 2022). In Manipur, the fruits are commonly used for throat infections and swelling. The Irula tribes of Tamil Nadu cook the unripe fruits as a vegetable, for meeting purpose such as both food and medicine (Revathi & Parimelazhagan, 2010). In South India, root poultices are applied for piles, while seeds mixed with mustard oil are burned, and the smoke is inhaled to relieve toothache, gum swelling, and other dental problems. The Mukunda tribes of Rajasthan apply root paste to treat hernia (Kumar, 2012). In Kerala's Wayanad region, the Kattunaikka, Paniya, and Kuruma tribes eat the fruits and seeds regularly as food and also use them for treating common ailments (Narayanan et al., 2011). Similarly, in Arunachal Pradesh, local tribes rely on the plant to manage digestive disorders. Owing to its many bioactive chemicals and rich ethnomedicinal value, *Solanum xanthocarpum* shows its potential for new herbal medicines .

Results and Discussion: The pharmacological significance of *Solanum xanthocarpum* has been supported by studies on its different plant parts, each expressing unique bioactive compounds and medicinal effects.

1. Leaves: Phytochemical studies confirmed the presence of solasodine, flavonoids (rutin, quercetin), and phenolic compounds in the leaves, which help the plant defend against harmful microbes by damaging their cell walls, thereby acting as antimicrobial agents (Pardhi et al., 2010; Kannabiran, 2009). These results validate their traditional use in treating gonorrhea and relieving pain through topical applications (Ghani, 1998). Recent studies also report that the leaves possess antioxidant, antimicrobial, anti-inflammatory, and blood sugar-reducing activities (Jain et al., 2025) supporting the role of leaves in managing infections and metabolic disorders.

2. Fruit: Researchers studies shows that fruit extract mainly contain bioactive compounds such as solasodine and other glycoalkaloids, are mainly responsible for their medicinal properties such as antifertility effects due to its ability to lower testosterone and affects sperm production (Dixit & Gupta, 1982), antiallergic and antimicrobial activity against bacterial and fungal pathogens (Soni et al., 2012; Rahman et al., 2013) , hepatoprotective potential (Mohan et al., 2014), antifertility effect (Dixit, 1980) and also act as anti-inflammatory, cytotoxic and antioxidant because of their ability to scavenge free radicals and prevent oxidative stress (Kumar & Pandey, 2014). Experimental studies further demonstrate that the fruits can protect the kidneys, reduce the risk of urinary stone formation (Arora & Ansari, 2019), and may also protect cartilage in arthritis, suggesting benefits for joint health (Shivnath et al., 2021). These results provide a scientific basis for the traditional use of fruits among tribal communities.

3. Seeds: Seeds contain alkaloids and glycosides that act as natural expectorants and therefore signifies their traditional use in relieving chest congestion and respiratory infections. Seed extracts have strong antioxidant properties, which reduce oxidative stress and may help protect reproductive health while preventing diseases linked to oxidative damage (Gupta et al., 2011). These findings highlight their relevance in both traditional and modern therapeutics.

4. Roots: Roots of *S. xanthocarpum* contain caffeic acid, oleanolic acid, esculetin, and scopoletin, belonging to phenolic, coumarin, and triterpenoid groups (Suthar & Banavaliker, 2010). These compounds contribute to important biological activities such as reducing oxidative stress, controlling inflammation and tissue-protective activities which signifies their traditional use in managing coughs, asthma, chest pain, and catarrhal fever (Sharma & Singh, 2012).

Clinical Relevance in Ayurvedic preparation : Several important herbal preparations in Ayurveda include *Solanum xanthocarpum* as a key ingredient. Dashmularishta, a traditional tonic, is widely prescribed to support the health of nursing women (Revathi & Parimelazhagan, 2010). Kantkari Ghrita, described in the Charaka Samhita, is especially effective for respiratory problems such as cough

and asthma, while Kanakasava is another classical formulation recommended for similar conditions. In modern practice, the polyherbal formulation Jigrine, which contains aqueous extracts of 14 medicinal plants including *S. xanthocarpum*, is used clinically for treating liver ailments (Chandana et al., 2011). These formulations highlight the extensive use of *Solanum xanthocarpum* in Ayurvedic medicine, underscoring its importance in treating a variety of illnesses.

Conclusion: In conclusion, *Solanum xanthocarpum* is a valuable medicinal plant with a wide range of pharmacologically active compounds contributing to its therapeutic effects. This review highlights its ethnomedicinal importance, documenting its traditional and modern uses in treating respiratory disorders, infections, digestive issues, and as antioxidant, anticancer, anti-HIV, anti-inflammatory, anti-allergic, and antifungal agent. The study states that the further research on Isolation and characterization of specific bioactive compounds moieties having potential biological activities may provide an effective therapeutic agent in future.

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