

Solanum Xanthocarpum-A Critical Approach to the Lesser Known Aspects of the Herb

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Abstract-Plant plays important role of medicinal source and food source for animal. The value of plants as a food and medicine has been studied in different parts of the world. About 80% of people on the planet still rely on and use Ayurveda today. Ayurvedic medicinal plants have great value in this aspect. *Solanum xanthocarpum* (SX) is widespread herbaceous weed distributed throughout India. SX is in danger of extinction and its supply is limited. Phytochemical production and biosynthesis can be stimulated using plant in vitro culture and elicitation. This Plant biodiversity is the large source of medicine, food. In Ayurvedic pharmaceutical *Solanum xanthocarpum* is an important herb for medicinal source. The *Solanum xanthocarpum* plant is a source of many phytochemical compounds that are useful against human pathogens, according to a number of analytical reports. Its plant parts have, antidiabetic, anti-oxidant, antifungal, anti-abiotic, antibacterial, anti-hypertensive, antiemetic, hypolipidemic, antivenom, anticancer. Fruits with a reddish-brown color are utilized for food.

Keywords- Traditional Medicinal Plants, West Bengal, Tribal Community, Ethnobotany, SX, *Solanum xanthocarpum*.

I. INTRODUCTION

Medicinal purposes are greatly benefited by natural products. Natural product Obtain various plant source which are used for medicinal purposes. Solanaceae is a large family that contain 2300 species. Commonly *Solanum xanthocarpum* (SX) belongs to Solanaceae family. India's indigenous population has been using medicine plants since the Neolithic period [1]. As a Solanaceae plant, SX is a part of the family. It is a small, semi prostrate, annual or perennial, Branches are numerous and herbaceous. All mortal societies used medicinal shops as a source of drug because of their vacuity in the original terrain, remedial conditioning, and smaller side goods [2]. Indian Ayurveda is a traditional system of medicine that dates back thousands of years. Ayurvedic medicinal plants have been extensively researched in pharmacognosy, chemistry, pharmacology, and clinical therapeutics. Medicinal plants are the integral part of mortal life to fight against several conditions from ancient time. More than 80,000 plants are used for medicine. Globally, 70% population utilizes traditional medicines, most of which are made from plants, and 80% of developing economies make use of them, according to the WHO's Strategy for Traditional Medicine 2014-2023.

It is a small, semi prostrate, annual or perennial and herbaceous. Many infectious and degenerative diseases are treated with this herb. *Solanum* plants are large number of important sources of phytochemical composites with

strong anti-mortal pathogen restoration capabilities. This plant produces tasty yellow berries with expanded calyxes that have been used for generations in folk medicine to treat a wide range of illnesses.

A recent study showed that SX fruit had anti-HIV, anti-inflammatory, anticancer, anti-vomiting, and anti-oxidant properties, in addition to anti-fungal and anti-microbial qualities. SX producing important phytochemicals, that's why enabling us to suggest this system as a substitute for the wild harvest of this endangered species. From the perspective of biosynthesis, these coumarins were derived from the phenylpropanoid pathway, namely from trans-cinnamic acid, more so through umbelliferone than by the lactonization reaction of the caffeic acid outgrowth, which resulted in the esculetin conformation.

Taxonomic Classification:

Kingdom- Plantae

Subkingdom - Tracheobionta

Division - Magnoliophyta

Class - Magnoliopsida

Subclass - Asteridae

Order- Solanales

Family - Solanaceae

Genus- *Solanum*

Species - *xanthocarpum*

Botanical name: *Solanum xanthocarpum* L

Synonym:

Latin: *Solanum xanthocarpum* L

Bengali: Kantakari
Hindi: Kateri, Kattay, Ringni.
English: Wild Eggplant
Sanskrit: Nidigdihika, Kantkari.
Malayalam: Kantakarivalutana, Kantkariccunta.
Tamil: Manathakkali
Urdu: Mako

II. GEOGRAPHICAL SOURCE

In India *Solanum xanthocarpum* plant is called Indian yellow berried nightshade or night-shade. SX grows as a weed along the sides of roads and in wastelands in dry conditions throughout all of India and in open spaces as well. It is found in Hooghly, Burdwan, North-24-Pargana, Bankura, Birbhum Kolkata, Midnapur, Kolkata in West Bengal. In wastelands, it is gradually propagated by seed. SX Worldwide distributed like as Asia, Malaya, Tropical, Polynessia, Auastrana and Ceylon [3].

III. MORPHOLOGY

Habitat: *Solanum xanthocarpum* is an annual or perennial herbaceous and tropical and subtropical areas are home to this thorny diffuse bright green perennial weed.

Hight: Woody base and found 2-4 m height throughout in India, it usually grows along roadsides and in arid wastelands.

Root: Root with few branches and numerus small lateral roots.

Stem: Herbaceous, erect or twin. Young branches covered with dense stellate tomentum.

Leaves: Veins are white, yellow, or green, and the leaves are 1.0-2 cm in diameter. There are usually 7-14 leaves with a length of 1.9-4.5 cm, simple, alternate, elliptic, or ovoid, sinuous opaque, exstipulate, hairy stellately present both sides. Petioles 1–2.4 cm long.

Inflorescence: Generally, cymose.

Flower: Flowering normally appears around November to May. Flowers are mostly White color, bisexual, regular, covered with stellate hairs (Figure 1).

Calyx: Calyx has five sepals, is over 1.2 cm long, and is spiky and heavily haired.

Corolla: Corolla is White, 1.9-2.2 cm long, 5 petals, gamopetalous, bell shaped, acute hairy outside.

Filament: Filament 1.4 mm long, glabrous, anthers 7 mm long, anther dithecos.

Fruits: 1.1 cm diameter, Berry-pale fruits, in young fruits are green (figure 2), and ripe fruit red color (Figure 3).

Seed: Seeds glabrous, smooth, and yellowish brown, Seeds with copious endosperm and straight or curved embryo.



Figure 1: Flower of *Solanum xanthocarpum*



Figure 2: Fruit of *Solanum xanthocarpum*



Figure 3: Ripe Fruit of *Solanum xanthocarpum*

IV. TRADITIONAL USE

An ancient Ayurvedic medicine, *Solanum xanthocarpum* is used in various forms [3]. The whole plant parts are used various treatment. For persistent malaria, ulcers, syphilis, and piles, leaf juice is utilized. Leaf and young fruits used as stomach disease. Leaf paste used as different pain. Fruits are not only utilized as foods but in treatments for inflammation and throat infections by several aboriginals.

Seeds are used chest pain, Cold, asthma, cough treatment. In Ayurvedic medicine, 'Dasmul Asava,' which is used as an expectorant, is well-known and to cure coughs, asthma, and chest pains, contains the roots as one of its prime constituents [4]. Rural and tribal communities in Orissa, India, have used the fruit of this plant to treat diabetes with a decoction [5]. Fruits are edible and are utilized by the locals for treating inflammation and throat infections. The ripe fruits' hot waterless extract is used as a traditional medicine by the Kondh tribes of Orissa, Bihar, India, to cure diabetes mellitus [7].

V. PHYTOCHEMICAL STUDIES OF SOLANUM XANTHOCARPUM

Ayurveda is the Indian traditional medicational system that can be considered one of the most ancient systems of medicine. Among the plants which have medicinal values, *Solanum xanthocarpum* is a well-known and used medicinal herb. A bright green perennial herb with a woody stem, in general, it stands between 2 and 3 meters high. It is used in Ayurvedic medicinal practices and acknowledged in the Hindu Materia Medica for its antibacterial, antiasthmatic, hypoglycemic, hepatoprotective and insect-repellent properties. Clinical trials have proved the efficacy as anti-inflammatory, antiallergenic, anti-anaphylactic, antitumor, and immunomodulation power (Parmer et al. 2010). It can in curing asthma, chronic cough, and catarrhal fever. Fruits are found to be rich storehouse of diverse Phytochemicals such as solamargine, solanacarpine, caffeic acid, coumarins like aesculin and aesculetin, steroids like triterpenes, diosgenin, campesterol and daucosterol. The glycoalkaloids that can be found in it can be toxic but also can lower cholesterol, and gives protection from *Salmonella typhimurium*. It also has a very high concentration of solasodine alkaloid with a heterocyclic nitrogen atom which manufactures cortisone and sex hormone. The alkaloid saponins of the fruit can be used to make alcohol and can stimulate the heart's functioning. These fruits have a decent amount of solasodine and diosgenin which can be used as a steroidal precursor. Aminoketal alkaloid or aglycon named solasodine is also present in these berries, depending on the climate of the tree bearing the fruits. Depending on the temperature, time of extraction, and concentration of hydrochloric acid, solasodine is recovered from fruits. Pure white crystals of solasodine can be obtained from it at the temperature of 196-297°C which is later converted into progesterone which is used in the oral contraceptive industry.

Campesterol is the first compound that is separated from the lipid fraction of the plant. It is expected to discover the biogenetic pathway of solasodine. The solasodine content of the fruits changes during their ripening process. The berries turn green to yellow to deep yellow as it ripe as the solasodine forms yellow colored complex with methyl orange extractable in chloroform. Stigmasteryl glucoside, cycloartenol, campesterol, stigmasterol, sitosterol, cholesterol, sitosteryl glucoside, cycloartenol, and solamargine are found in abundance from the fruit extract of *Solanum xanthocarpum* and are chemically identified (Parmer et al. 2010).

Table 1: Phytochemical constituents in *Solanum xanthocarpum* leaves and stems (source: Yogananth et al., 2016).

Phytochemical	Extract of Leave		Extract of Stem	
	Ethanol	Acetone	Ethanol	Acetone
Alkaloid	++	++	+	+
Phenol	-	-	+	-
Flavonoid	++	++	+	++
Phlobatannin	+	-	-	+
Steroid	+	-	-	-
Saponin	-	++	+	-

VI. PHARMACOLOGICAL USE

Various solvent extracts, *Solanum xanthocarpum* showed different biological activities in animal models. The stem, leaf, flower, fruits, roots have pharmacological activity e.g., anti-inflammatory, anti-oxidant, anti-asthmatic, anti-bacterial, anti-diabetic, antiemetic, mosquito larvicidal, anti-ulcer effect, anti-fungal, anthelmintic. These pharmacological are described as follows.

Anti-asthmatic properties:

It is estimated that 8-12% population of the world suffers from chronic bronchitis. The seditious condition known as bronchial asthma affects the airways and is distinguished by bronchial hyperresponsiveness, eosinophilic inflammation, and colored airway inhibition. It is a major global health issue caused by a complicated interaction between inherited and environmental factors. Inflammatory disorders of the airways such as asthma have various symptoms including obstruction, eosinophilic inflammation, and hyperresponsiveness to the air [10] and because of the intricate interactions between genetic and environmental factors, it is a problem for global health [1]. 7 – 10 man's are affected from bronchial asthma in the world. Large range of medicines, the alleviation afforded substantially characteristic and short-lived. To treat respiratory ailments, Siddha system of medicine interpreters in southern India frequently employ *Solanum xanthocarpum*. For respiratory treatment dried whole plants or decoctions are used. In patients with mild or moderate asthma, SX significantly improved the pulmonary functioning. This effect is observed within 6-8 hours. It was proposed that SX may be responsible for the alleviation of bronchial asthma symptoms (i) impact of a bronchodilator, (ii) Edema of bronchial mucosa is reduced, (iii) Airway lumen concealment is reduced [7].

Anti-diabetic Activity:

The condition of diabetes is chronic and progressive and is a result of insufficient insulin production. It is one of the treatments for type 2 diabetes to control blood sugar levels after food intake. Glucose levels in the body can be controlled by blocking the actions of intestine pancreatic amylase and/or glucosidase. Fruits and leaves of *S. xanthocarpum* have historically been treated for its implied anti-diabetic properties, and animal models have demonstrated the anti-hyperglycemic effects of the related extracts [9]. You can do this by inhibiting intestinal and pancreatic enzymatic activity of glucose-consuming enzymes. It is possible that increasing anti-hyperglycemic medications inhibit intestinal and/or pancreatic compounds α -amylase. LD50 of the excerpt should provide adequate protection against diabetes, according to estimates.

Anti-Inflammatory:

The body naturally attempts to remove a meddlesome object when it detects one. The bushwhacker might be a disease, a foreign body, or something else comparable. Infections are caused by pathogens, which include contagions, bacteria, and other organisms. Acute inflammation is characterized by five major symptoms: (i)Redness (ii)Agony (iii)Swelling (iv)Heat (v)Loss of function.

Among the most important classes of phenylpropanoids are those which are used in the modification of industrial extracts to reduce inflammation as well as their ability to inhibit inflammation-causing enzymes. Additionally, to inhibiting COX-2 and COX-1, lipoxygenase (15-LOX) and phospholipase A2 (sPLA2), the anti-inflammatory action reduces leukotrienes and prostanoid levels [10].

Mosquito larvicidal effect:

Fruit samples from *SX* showed larvicidal activity against *Cx. Quinquefasciatus*, and one species of culicine, *Ae. Aegypti*, *An. stephensi* [7]. Oil paintings from extract of *SX* has shown remarkably quiet impressive repellency to the mosquito *Culex quinquefasciatus*. At LC50 and LC90 levels, fruit extract demonstrated murderous attention against *Anopheles culicifacies*, *Anopheles stephensi*, and *Aedes aegypti*, respectively, following a range of 0.112-2.256, 0.058-0.289, 0.052 - 0.218. The root extract and stem extract also use against anopheline and culicine mosquito species. As compared to the fruit excerpt though in advanced attention, root excerpt of the factory showed significant exertion against anopheline and other clinical species of mosquitoes.

Anti-ulcer Activity:

Ulcers are abscesses on the lining of your small stomach or intestine. Abscess also could be on your esophagus (throat). The most of ulcers, known as duodenal ulcers, are found in the small intestine. Stomach ulcers also known as gastric ulcers and Throat Ulcers known esophageal ulcers. When comparing the antiulcer activity of petroleum ether and chloroform, leaves extracts of *SX* perform better in the lean to phase.

Antioxidant Activity:

These molecules may guard your cells from free radical damage, which can cause heart disease, cancer, and other diseases. Vitamin C, Vitamin E and beta-carotene are the three primary antioxidant vitamins. Thirumalai et al. studied the impact of a waterless extract of *SX* seed on the spermatozoa of the caudal epididym oxidative outcome in male albino rats [12].

Antimicrobial Activity:

The shops generally retain antimicrobial substances for their own protection from microbial infection and deterioration; that's why they're being used for the conservation and safety of food products [12]. Leaf extract of *SX* is used against *Streptococcus species*, *Vibrio cholera*, *Escherichia coli*, *Salmonella typhi*. Kajarja et al. detected that splint excerpt displayed MIC of 12.5 mg/ ml for *Escherichia coli*, 16 mg/ ml for *Pseudomonas aeruginosa* showed maximum zone of inhibition and 6.25 mg/ ml against *Staphylococcus aureus* [14]. *SX* exhibits greater antibacterial efficacy against Gram-negative bacteria such *Pasteurella maltocida*, *Escherichia coli* and *Salmonella typhi*. Fruit Excerpts may serve as a salutary source of artificial medicines useful in treatment of some bacterial infections. *SX* plant contain glycosides, lignins, tannins and alkaloids like as sesquiterpenes, monoterpenes and triterpenes, probably these compounds get through the bacterial and fungal cell wall and suppress fungal and bacterial growth. *Solanum xanthocarpum*'s fruit no showed antibacterial activity against *Bacillus subtilis*, *Escherichia coli* but exhibited activity against *Salmonella typhi*. Salar et al. revealed that the antimicrobial effect of colorful excerpts against the fungus *Aspergillus niger* and *Staphylococcus aureus* bacteria, *Escherichia coli*, *Pseudomonas aeruginosa* [15-20].

Anti-helminthics:

Anthelmintics are medications used for treating parasitic worm infestations in animals. WHO reported that Helminthiasis is a common and global disease in all age group. Tribal people used *SX* against helminthic activity. *SX* of methanolic and aqueous extracts showed anthelmintic activity of parasite.

VII. CONCLUSION

Unavoidable drug systems are a crucial component of healthcare globally, and many associations and healthcare practitioners are being pressured to think about incorporating them into their practices and treatment recommendations. In a comprehensive literature review, it was discovered that *SX* contains several important chemicals with medicinal and pharmacological value, including solasodine, campesterol (C₂₈H₄₈O), kaempferol, diosgenin, and colorful alkaloids. These natural conditioning were nearly associated with the product of secondary. *SX* from the wild serves as a source of phytochemicals for conventional usage and serves as a tempting model for research on the metabolic control of coumarins and caffeic derivatives. Even though *SX* has

been used successfully in the ancient science of Ayurveda, further clinical studies need to be done to back up its therapeutic usage. Additionally, when combined with other herbal medications, the factory's therapeutic potential should be examined.

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