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REVIEW ARTICLE

A PHYTO PHARMACOLOGICAL REVIEW OF MEDICINALY IMPORTANT PLANT *SOLENA AMPLEXCAULIS* (CUCURBITACEAE)

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ABSTRACT

Solena amplexicaulis, (Cucurbitaceae) commonly known as the creeping cucumber, native to tropical southern Asia. It is generally prescribed for wound healing by the local healers in western districts of Tamil Nadu. The fruits, leaves, roots and shoots have used as food and it is traditionally used as astringent, appetizer, carminative, cardiotonic, digestive, diuretic, expectorant, invigorating, purgative and stimulant. It have lot of medicinal uses such as antioxidant antidiabetic, antibacterial etc. The available reports on physicochemical, anti-microbial activity, anti-oxidant activity and pharmacological value of *Solena amplexicaulis* are discussed in this review.

Keywords: *Solena amplexicaulis,* pharmacological studies, phytochemical screening.

1. INTRODUCTION

Herbal plants are integral parts of the traditional medicine worldwide and most of the rural and urban population used these plants in many of their regular needs even today. The current researchers are more focused on natural chemicals than the synthetic chemicals due to their environmental, economical and health benefits. Plants produce many chemical compounds for its biological activities against microbes, insects and herbivors and these chemicals are called as phytochemicals. Herbal plants are a natural source of many important phytochemicals and widely used in pharmaceutical, food and cosmetic industries. A wide variety of herbal plants are available in the Indian subcontinent and they are the backbone of Indian traditional medicines such as Ayurveda Siddha and Unani.

Solena amplexicaulis is a perennial dioecious climber with tuberous root found throughout Asia mainly growing in hilly dry deciduous forests, scrub jungles. The tubers, leaves and seeds are extensively used in traditional system for various ailments like hepatosplenomegaly, spermatorrhoea, appetizer, cardiotonic, diuretic and thermogenic, haemorrhoids and invigorating [1]. The leaves have good anti-inflammatory activity and also prescribed for skin lesions and other skin diseases [2].

Due to the importance of *Solena amplexicalis* in modern medicine as a potential candidate for curing many diseases. In this regard, the phytochemical study, antimicrobial property, antioxidant property and the pharmacological value of this plant is explained in this review.

2. PLANT DESCRIPTION

Solena amplexicaulis is found in Sri Lanka, Pakistan, India, Nepal, Bangladesh, Myanmar, Indonesia, Vietnam and China at altitudes of up to 2,600 m (8,500 ft). It grows in a range of habitats including tropical mixed forests, thickets, hilly areas, semi-cultivated areas and roadside verges [3]. It also found in Chittagong, Chittagong Hill Tracts [2]. In India as the foothills of both Western and Eastern Ghats around 600m above in certain localities where dry deciduous forest/scrub jungles are available, it is present with less population size.

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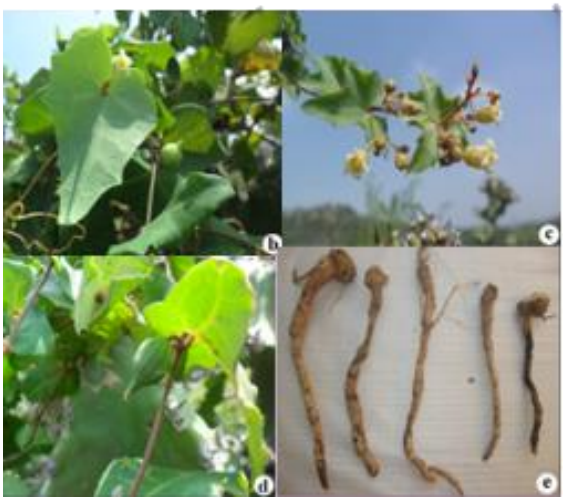


Figure 1. a) Habit b) Female flower, c) Male flower, d) Fruit, e) Tuber

2.1. Distribution

The systematic position of this species according to Bentham and Hooker (1862-1883) system of classification is given below:

Division	:	Phanerogams
Class	:	Dicotyledons
Subclass	:	Polypetalae
Series	:	Calyciflorae
Order	:	Passiflorales
Family	:	Cucurbitaceae
Genus	:	*Solena*
Species	:	*Amplexicaulis*

2.2. Synonyms

The vernacular names are given in the Table 1

S.No	Language	Vernacular Name
1	Bengali	Kudri
2	Hindi	Van kakdi, Amantamul, Ban kakra, Tarali
3	Kannada	Bimpuli
4	Malayalam	Nerinnampuli
5	Marathi	Gometi
6	Nepali	Ban kankro
7	Oriya	Kamaraja
8	Sanskrit	Amlavetasah
9	Tamil	Pulivanchi
10	Telugu	Adavi donda, Tigadonda
11	Urdu	Bankakra

2.3. Botanical description

Solena amplexicaulis is a dioecious perennial climber with many spindle-shaped tuberous roots which are 1.5-2 cm in diameter and with slender branched furrowed, stems bearing simple tendrils; Leaf-stalk slender, 4-10 mm, finely velvet-hairy at first, becoming hairless after some time. Leaf blades are very variable may be polymorphous, ovate, suborbicular, oblong or narrowly lanceolate in shape, 3-5 angled or lobed, lobes are lathery, usually cordate at base, reticulately veined beneath, margins remotety denticulate, oblong-lance shaped, lance shaped, or triangular, 8-12 × 1-5 cm, below densely bristly or almost hairless, above densely bristly or scabrous, base heart-shaped, margin entire or toothed, tip blunt or tapering. Flowering and fruiting: May to January [3].

2.4. Flowers

Flowers are yellow or yellow-white in colour, petals are triangular in shape, 1-1.5 mm in size, tip of petals are blunt or pointed, filaments are threadlike, about 3 mm in length. Male flowers are umbellate or subumbellate, flower-cluster-stalk is very short, apically with 10-20-flowered. Flower-stalks are 2-8 mm in length, calyx tube about 3-5 mm in length and about 3 mm in diameter. Female flowers are usually solitary, flower-stalk is about 2-10 mm in length, finely velvet-hairy, calyx and flower of female flower is same as male flowers [3].

2.5. Seeds

Seeds are subcircular in outline, pale creamy brown with conspicuosly, nearly round or ovate in shape, 5-7 × 5-6.5 mm in size and smooth or slightly tuberculate [3].

3. TRADITIONAL USES

The unripe fruits of *Solena amplexicaulis* are used for making salads and in curries, and leaves, stem and tubers are used for edible purpose [4]. In Chhattisgarh, the fruits and roots are consumed to assist in the digestion of bushmeat. Creeping cucumber can be gathered from the wild or can be cultivated as a field crop and given suitable supports over which to climb [5].

In traditional medicine, the tuberous roots of *Solena amplexicaulis* are used to treat anorexia, digestive problems, flatulence, asthma, gonorrhoea and spermatorrhoea, and extracts of the leaves are widely used to treat inflammation. Whole plant used to cure jaundice [6]. The tubers, leaves and seeds of the plant are extensively used in traditional system for various ailments like gonorrhea, dyspepsia, asthma, appetizer, spermatorrhoea, thermogenic, hepatosplenomegaly, cardiotonic, diuretics, haemorrhoids and invigorating.

The whole plant is a potential source of natural antioxidant activity [7,8]. Plant pacifies vitiated kapha, vata, anorexia, dyspepsia, colic, asthma, cough, renal calculi, urinary retention and constipation. It is useful in paralytic disorder also [9].

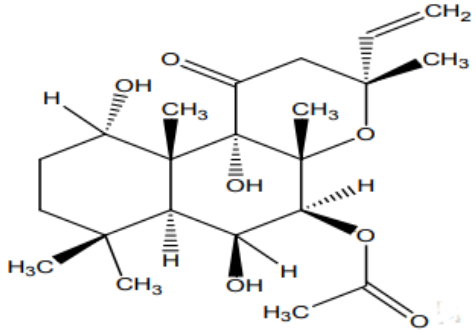
Table 2. Ethnopharmacological uses of *Solena amplexicaulis*

Part	**Value**	***Reference***
Whole plant	Jaundice, Swelling	[6]
Leave	Anti-inflammation	[1]
Root	Dyemenorrhea, Leucorrhea, Infertility of women.	[10]
The young unripe fruit	Used as vegetable(edible)	[4]
Whole plant	Cough, constipation	[9]

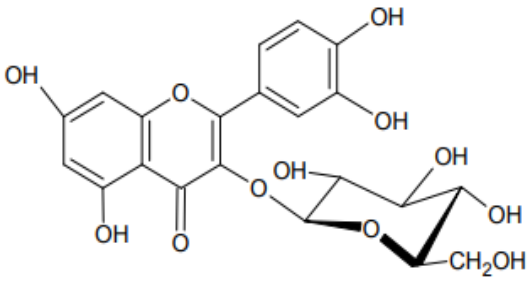
This plant is widely used in the tropical Asia and other localities in the management of various ailments, as summarized in Table 2. Its ethnomedicinal popularity has warranted the various activities of the plant to be documented in several research publications. In West Bengal Lodha people use the root medicinally for leucorrhea and infertility of women [4].

4. PHYTOCHEMICAL STUDY

Phytochemical screening of various extracts such as chloroform, ethanol, water of *Solena amplexicaulis* root, stem and leaf revealed the presence of secondary metabolites such as Steroids, triterpenoids, sugars [11] (Agarwal & Jain 2018), Reducing sugars, phenolic compounds, tannins, anthroquinone, amino acids, saponins [8]. Phytochemical analysis of dried powder of *Solena amplexicaulis* leaves showed the presence of carbohydrates, saponins, phytosterols and tannins, whereas the stem portion possess carbohydrates, saponins, phytosterols, tannins, flavonoids and cardiac glycosides [2]. Active chemical compounds such as (Figure 2) forskolin and isoquercetin were isolated [1,8] from the methanolic extract of leaf and tuber.



(a)



(b)

Figure 2: Structure of the isolated compounds a) Forskolin b) Isoquercetin from the methanolic extract of leaf and tuber part of *Solena amplexicaulis* Isoquercetin [1,8].

5. PHARMACOLOGICAL STUDY

5.1. Antimicrobial study

Karthika and Paulsamy [12] evaluated the aqueous and organic solvent extracts (hexane, benzene, chloroform and methanol) of aerial parts of S. amplexicaulis on 15 human pathogenic bacteria. The result showed that the chloroform and benzene extract of stem exhibited significant antibacterial activity compared to the leaves part. Ethanolic root-extract of the plant showed the

most promising result again both gram positive and gram negative bacteria [2].

5.2. Antioxidant activity

The investigation of ascorbic acid and ethanolic extract of *S. amplexicaulis* root was performed for its antioxidant activity. The findings of this study showed that the highest scavenging activity for ascorbic acid and ethanol was 98.66% and 93.97% at concentration 1000 µg/ml [2].

In vitro antioxidant activity of *S. amplexicalis* root was studied by using of various alcoholic and aqueous extracts of tuber the result showed good antioxidant activity and it were compared with synthetic (BHA and BHT) as well as natural antioxidants (rutin and quercetin) [8].

5.3. Anti-inflammatory activity

S. amplexicaulis produced a potent anti-inflammatory activity against the paw edema in Swiss albino rats [2]. The aqueous extracts of leaf was examined for anti-inflammatory activity by administration to Swiss albino rats against Diclofenac sodium drug (20mg/kg) as standard reference and normal saline as control by Randall and Baroth method. And its derivative exhibited anti-inflammatory activity [13]. The oral administration of forskolin (10 mg/kg) was studied for anti-inflammatory activity. The findings of this study show that potent anti-inflammatory activity by reducing paw edema (87.79%) than the crude extract (150 and 300 mg/kg) and it was comparable with the standard drug, indomethacin (10 mg/kg, 93.89%) [8].

5.4. Antidiabetic activity

According to Kabir *et al.* [2] the ethanolic extract of *S. amplexicaulis* showed higher percentage of α-amylase inhibitory The result shows that leaf and stem extracts have to possess anti-diabetic activity in terms of their α -amylase inhibition activity.

Venkatachalapathi *et al*. [14] evaluated the antidiabetic activity of crude methanol leaf extract of *S. amplexicaulis* (MeOHSa) and its isolated compound Forskolin in Wistar albino rats. The effect of MeOHSa and Forskolin on oral glucose tolerance in the normoglycemic rats were studied. The administration of the MeOHSa and Forskolin significantly ($P < 0.05$) improved the activities of enzymatic and non-enzymatic antioxidants in the diabetic induced rat.

5.5. Hepatoprotective studies

The investigation of methanolic extract of *S. amplexicalis* was carried out by administration albino rat and analyzed parameters include ALT, AST, ALP, TPL & ALB activity and histopathology of liver damage. This study creates the social awareness among the liver disorders patient who were infected by excess consumption of alcohol [15].

5.6. Acute toxicity

Kabir *et al.* [2] evaluated the ethanolic extract of the root of *S. amplexicaulis* on albino mice for acute toxicity study. The finding of the study showed the acute toxicity of the extract on mice administered orally in the range from 50 to 150 mg/kg bodyweight of mice. While it administered orally.

5.7. Analgesic activity

Analgesic activity of the ethanolic extract of *S. amplexicaulis* root was investigated on mice. Acetic acid induced writhing response model used for the assay of analgesic activity. The ethanolic extract of this plants exhibited the higher considerable degree of inhibition (26.22%, 14.63%, and 3.05%) which was found less than that of standard diclofenac sodium (51.83%) [2].

5.8. Urinary stone prophylaxis activity

Various parts of *S. amplexicaulis* such as stem, leaves and seed were investigated for the inhibition of the mineralization of urinary stone to reduce the deposition of Calcium phosphate and Calcium carbonate crystals. This study suggested that the fruit and seed extract exhibit the good urinary stone prophylaxis activity.

6. CONCLUSION

The extensive survey of literature revealed that *S.amplexicaulis* is an important source of many pharmacologically and medicinally important chemicals, especially forskolin and isoquercitin and various useful alkaloids. This plant is extensively studied for the various pharmacological activities like hepatoprotective, anti-inflammatory, anti-microbial and antibacterial activities. Although the results from this review are quite promising for the use of *S. amplexicaulis* as a multi-purpose medicinal agent, while this plant has been used successfully by tribes as a medicine for centuries, more clinical trials should be conducted to support its therapeutic use. The research on the

pharmacological value of this plant proves that it has valuable compounds for curing many diseases and thus it is a promising plant for future advanced medicine. The traditional uses, toxicity pharmacology and phytochemistry of *S. amplexicaulis* presented in this review could be helpful for future studies and research and new molecules could be discovered from this plant against the life threatening diseases like cancer. The plant has good future prospective for discovery of new molecules and pharmacological activities.

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