

# Phytochemistry and pharmacological activity of *Scindapsus officinalis*: A review

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## Abstract

The herbal medicines are used in the ailment of several diseases from the ancient time. India is known worldwide for its Ayurvedic treatment. *Scindapsus officinalis* is often used traditionally for erectile disorders, respiratory diseases such as cough, bronchitis, pharyngitis, asthma and other worm infestation, dysentery, troubles of the throat, ozoena, rheumatism arthritis, and diarrhea. It is also used as carminative, anthelmintic, cardiogenic, diaphoretic, antiprotozoal (fruit), hypoglycemic (stem and fruit), anti-inflammatory, analgesic, antiasthmatic, cytostatic and antimicrobial steroids, flavonoids, and terpenoid which are characterized in the ethanolic extract of *S. officinalis*. This review describes the general information (distribution and plant description), description (macroscopic and microscopic), chemistry, ethnopharmacology, traditional uses, medicinal uses, and other important information about the plant *S. officinalis*.

**Key words:** Pharmacology, phytochemical, Traditional uses, *Scindapsus officinalis*

## INTRODUCTION

The genus *Scindapsus* Schott (1832) contains about 35 species from Northeastern India to Western Polynesia. It is an epiphytic climbing shrub, with ovate-oblong, ovate-oblong cordate or oblong-lanceolate leaves bisexual flowers and naked spathe. Florets are without perianth, each having four stamens and a one-celled ovary with a solitary basal ovule. About 15 species of the plant and numerous hybrids, all of which are evergreen, root clinging climbers with juvenile and adult stages, belong to this genus. The various species of genus *Scindapsus* include *Scindapsus caudatus*, *Scindapsus decursivus* Schott (Sylhet, Bangladesh), *Scindapsus giganteus* Schott (Penang, Singapore), *Scindapsus glaucus* Schott (Khasaya Paras, Nepal), *Scindapsus officinalis* Schott (India, Burma), *Scindapsus peepla* Endl (Sylhet, Bangladesh), *Scindapsus pertusus* Schott (Coromandel, South Konkan), *Scindapsus pinmatifidus* (Roxb.), *Scindapsus pictus* (S. pictus), *Scindapsus scortechinii*, *Scindapsus hederacea*, *Scindapsus perakensis*, *Scindapsus crassipes*, *Scindapsus beccarii*, and *Scindapsus cuscuaria*. *S. officinalis*, a plant with perennial stem, is a large epiphytic climber with adventitious aerial roots growing on trees and rocks. The mature inflorescence without the spathe is transversely sliced into pieces and dried and is commonly known as "Guj-pippul." In Ayurvedic system of medicine, it is known to cure "atisara" (diarrhea),

"svasa" (dyspnea), "kanthmaya" (throat diseases), and "krimi" (parasitic infestation).<sup>[1-4]</sup>

## TAXONOMICAL CLASSIFICATION

The botanical name of Gajapippali is *S. officinalis* (Roxb) Schott. It belongs to plant family Araceae. Below is given taxonomical classification of plant.

- Kingdom: *Plantae*
- Phylum: *Magnoliophyta*
- Class: *Liliopsida*
- Order: *Alismatales*
- Family: *Araceae*
- Genus: *Scindapsus* Schott
- Species: *Scindapsus officinalis* (Roxb)Schott

## MORPHOLOGICAL DESCRIPTION

Traditional medicine based on herbal remedies has played a key role in the health system of many countries. The value

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and importance of traditional knowledge are now being increasingly all over the world. In India, between 2500 and 500 BC, Ayurvedic concept appeared. The literal meaning of Ayurveda is “science of life,” because ancient Indian system of health care focused views of man and his illness. Of the 2, 50,000 higher plant species on earth, more than 80,000 are medicinal. India is one of the world’s 12 biodiversity centres with the presence of over 45000 different plants. The leaves of *S. officinalis* are large (upto 25 cm long), leathery, with dark green peduncle. They are solitary with terminal much shorter than the petiole. Their shape is ovate, elliptic ovate or nearly orbicular, caudate acuminate with rounded or slightly cordate base. The primary nerves are distinct, marked with the presence of dilated or winged petiolar sheaths. The stem of the plant is as thick as a little finger and turns almost woody when old. The roots of the plant are adventitious and aerial, clinging on trees and rocks [Figure 1].

## VERNACULAR NAMES/SYNONYMS

1. Sanskrit: Gajakrishna, Hastipipali, Gajapippali, Karippipali, and Kolavalli
2. Siddha: Anaitippili
3. Bengali: Gajapeepal and Gajapipul
4. Gujarati: Motopeepar
5. Hindi: Gajapeepa.

## TRADITIONAL AND CONTEMPORARY USES

According to Ayurveda, *S. officinalis* is used to treat “atisara” (diarrhea), “svasa” (dyspnea), “Krimiroga” (worm infestation), and “kanthyaroga” (throat infections). According to Ayurveda, the pharmacodynamics of the plant is explained by “Rasa” (taste), “Guna” (property), “Virya” (potency), “Vipaka” (post-digestive effect), and “Karma” (pharmacology). The taste of the plant is pungent, with dry and sharp properties. The roots have hot (“Ushna”) potency



Figure 1: *Scindapsus officinalis* plant with fruit

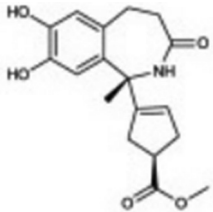
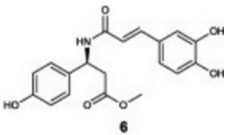
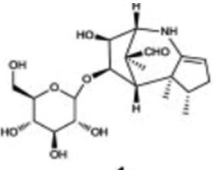
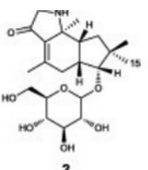
and the fruits have cold (“Sheeta”) potency. The fruits have sweet post-digestive effect.<sup>[5]</sup> The pharmacological activities of the plant include “Dipana” (increasing appetite), “Agnivardhak” (peptic), treating “Kanthya” (throat infections), “Kaphahara” (productive cough), “Stanya” (breast problems), and “Varnya” (improving skin complexion).<sup>[6]</sup>

## Phytochemistry

The fruits contain two glycosidic substances - scindapsin A and scindapsin B which on hydrolysis yield aglycon, sugars such as rhamnose, fructose, glucose, and xylose together. Fixed oil, which present in fruits are 11-hydroxy-cis, cis-5,8- tetracosadienoic acid, cyclopropenoid fatty acids, piperine, mixture of glycerine and ascorbic acid, and ascorbic acid.<sup>[1,7]</sup>

The structures of scindapsin A and scindapsin B are  $C_{26}H_{32}O_{14}$  and  $C_{31}H_{28}O_{13}$ , respectively, which on hydrolysis yield the aglucones scindapsinidine A ( $C_{25}H_{16}O_7$ ) and scindapsinidine B ( $C_{20}H_{22}O_9$ ), respectively. A sterol ( $C_{30}H_{50}O_2$ , m.p.2700 decomp.) and three unidentified colorless substances ( $C_{20}H_{28}O_3$ ,  $C_{18}H_{24}O_4$ , and  $C_{17}H_{30}O_3$ ) have also been isolated from the fruit extract. A new hydroxy fatty acid characterized as 11-hydroxy-cis, cis-5,8- tetracosadienoic acid along with cyclopropenoid fatty acids are also one chemical compounds present in the oils of *S. officinalis* which are identified by some spectroscopic techniques such as infrared (IR), nuclear

Table 1: Chemical compounds present in *Scindapsus officinalis*

Chemical compounds	Structure
Scindapsin A	
Scindapsin B	
cyclopropenoid fatty acids	
11-hydroxy-cis, cis-5,8- tetracosadienoic acid	

**Table 2:** Biological properties of *Scindapsus officinalis* (Roxb.) in different extracts

Pharmacological activities	Plant part	Extract	Compound
Hepatoprotective activity	Fruit	Hydroalcoholic extract	11-Hydroxy-cis, cis-5,8- tetracosadienoic acid
Anthelmintic activity	Fruit	Aqueous extract	11-Hydroxy-cis, cis-5,8- tetracosadienoic acid
Analgesic and anti-inflammatory activities	Fruit	Methanolic extract	11-Hydroxy-cis, cis-5,8- tetracosadienoic acid
Anticancer activity	Fruit	Methanolic extract	11-Hydroxy-cis, cis-5,8- tetracosadienoic acid

magnetic resonance, mass spectrometry (MS), and chemical degradation [Tables 1 and 2].<sup>[8,9]</sup>

## Pharmacological Activity

### Antioxidant activity

Coarse powder of *S. officinalis* (Roxb.) Schott. fruit was extracted successively using hexane, chloroform, ethyl acetate, and 50% ethanol. The ethyl acetate and 50% ethanolic extracts were investigated for its antioxidant activity using nitric oxide and 2,2-diphenyl-1-picrylhydrazyl radical scavenging methods. The IC value was also calculated and ascorbic acid was used as standard. Both the 50% ethanolic and ethyl acetate extract were found to exert concentration-dependent free radical scavenging activity, but former extract was more effective than the later on. The highest free radical scavenging activity by *S. officinalis* fruit extracts was observed at a concentration of 1000 µg/ml.<sup>[10]</sup>

### Antidiabetic activity

Ethyl acetate (EAESOF) and ethanolic (EESOF) extract of *S. officinalis* fruit were subjected to the phytochemical investigation and evaluated for antidiabetic activity on blood glucose level, lipid profiles, and on the body weight in alloxan-induced diabetic rats. EAESOF and EESOF (200 mg/kg) and glibenclamide (10 mg/kg) were administered orally in alloxan (120 mg/kg, i.p.) induced diabetic rats. In this antidiabetic study, maximum reduction in blood glucose was observed in EAESOF and EESOF (160.8, 96.7 mg/dl) at the dose of 200 mg/kg on 21<sup>st</sup> day, respectively. The EAESOF and EESOF showed the significant effect ( $P < 0.005$ ) in the various biochemical parameters such as protein, triglycerides, cholesterol, and total lipid levels. EAESOF and EESOF prevented further loss of body weight. EAESOF and EESOF (200 mg/kg) were found to have significant ( $P < 0.001$ ) blood glucose lowering effect. Preliminary phytochemical investigation revealed the presence of alkaloids, flavonoids, saponins, and tannins as the major constituents in the ethyl acetate and ethanol extract. These results suggest that EAESOF and EESOF (200 mg/kg) showed antidiabetic activity in alloxan-induced diabetic rats.<sup>[11]</sup>

The fruit was further subjected to antidiabetic study

through six segment method and was investigated for antihyperglycemic effects in long Evans rats. The antidiabetic effects were estimated by measuring the amount of glucose in the samples, collected from six different segments of the gut, after the experiment. The amount of sucrose unabsorbed in different GIT segments were evaluated in control rats versus rats fed with 500 mg/kg extract at 30 min, 1 h, 2 h, and 4 h. Phytochemical analysis of the ethanolic extract of *S. officinalis* has indicated the presence of steroid, carbohydrate, flavonoid, alkaloid, tannin, saponin, and terpenoid- compounds. The extract caused a significant ( $P < 0.05$ ), dose-dependent inhibition of glucose absorption and showed hypoglycemic effects in rats weighing from 80 to 200 g. In conclusion, these observations provide evidence and possible mechanisms of action for the medicinal properties of fruit of *S. officinalis* claimed in Ayurveda medicine.<sup>[12]</sup>

### Anticancer activity

*S. officinalis* (Roxb.) Schott fruits extract was evaluated for antioxidant and anticancer activity. An *in vitro* cytotoxic assay using the brine shrimp lethality assay with brine shrimp eggs (*Artemia salina*) at a dose of 1–10 µg/ml with the fruit extract was performed by the method described by Mayer *et al.* Cell viability using the Trypan blue dye exclusion test at a dose of 20, 40, 80, 120, and 160 µg/ml dissolved in dimethyl sulfoxide (final concentration 0.1%), and cytotoxicity using the MTT assay where viable cells convert MTT into a formazan salt were performed. All pharmacological screening for acute toxicity and antitumor studies using EAC  $1 \times 10^6$  cells/mouse treated Swiss albino mice at a dose of 100 and 200 mg/kg/day orally was carried out. Biochemical and antioxidants predictions from various parameters such as hematological, red blood cells, white blood cells count, packed cell volume, total protein, tissue lipid peroxidation, superoxide dismutase (SOD), CATALASE, glutathione peroxide (GPx), glutathione – S – transferase (GST) levels, and antitumor activity of *S. officinalis* were observed. The data were statistically analyzed by one-way ANOVA followed by Dunnett's and Tukey's multiple comparison test. The antitumor effect of the extract is evident from the increase in mean survival time lifespan, reduction in the solid tumor volume, and also the reversal of altered hematological parameters almost equal to normal. The methanolic extract (100–200 mg/kg/day orally) was found to be cytotoxic on

human cancer cell lines. In addition, the methanolic extract had an antioxidant effect as reflected by a decrease in LPO, GST, and GPx (oxidant enzymes), and an increase in SOD and catalase.<sup>[13]</sup>

### **Analgesic and Anti-inflammatory Activities**

Methanol extract of the root of *S. officinalis* (200, 400, and 600 mg/kg) was evaluated for analgesic and anti-inflammatory activities using acetic acid-induced writhing, hot plate, carrageenan-induced-inflammation, and cotton pellet-induced granuloma method. The methanol extract exhibited significant ( $P < 0.001$ ) inhibition of acetic acid-induced writhing in mice and a significant ( $P < 0.001$ ) dose-dependent increase in latency time. The methanol extract also produced a significant ( $P < 0.001$ ) anti-inflammatory effect in a dose-dependent manner in carrageenan-induced inflammation which is comparable to that of the reference drug diclofenac sodium (10 mg/kg).<sup>[13,14]</sup>

The experimental activities for the ethanolic extract of *S. officinalis* fruit exhibited statistically significant ( $P < 0.05$ ) anti-inflammatory activity in Carrageenan-induced Hind Paw Edema in long Evans rat and statistically significant ( $P < 0.05$ ) analgesic activity in Swiss albino mice in a dose-dependent manner. In conclusion, these observations provide evidence and possible mechanisms of action for the anti-inflammatory and analgesic properties of fruit of *S. officinalis* claimed in Ayurveda medicine. Further studies should be undertaken to correlate the pharmacological activities with the chemical constituents of the fruit of *S. officinalis*.<sup>[14,15]</sup>

### **Anthelmintic activity**

*In vitro* anthelmintic efficacy of an aqueous extract of *S. officinalis* (Roxb.) Schott fruits was evaluated against *Haemonchus contortus* of small Ruminants.<sup>[15-17]</sup>

### **Antiasthmatic activity**

Methanolic extract of fruit of *Scindapsus officinalis* (MESO) showed the antihistaminic (H1 receptor antagonist) activity. In-vivo and in-vitro models such as Histamine-induced Bronchospasm in Guinea pigs and Isolated Guinea pig ileum preparation respectively were used to evaluate the antiasthmatic activity. In-vitro study, increase in the contractile responses of the tissues significantly at the different doses of 50, 100 and 200 µg/ml. In-vivo study, different doses of 50, 100 and 200 µg/ml of MESO showed the significant increase in preconvulsion time. Alkaloids, tannins, saponins, flavonoids, glycosides, phenolic compounds, terpenoids and steroids were reported in MESO extract.<sup>[18-20]</sup>

### **Antimicrobial activity**

Methanolic extract of *Scindapsus officinalis* (MESO) were assayed for activity against eleven strains of bacteria and four strain of fungi. Fruit of *Scindapsus officinalis* show the antibiotic, and the antiviral potential. No zone of inhibition

are shown in *Bacillus subtilis*, *Staphylococcus aureus*-methicillin resistant, *Streptococcus faecalis*, *Pseudomonas aeruginosa*-sensitive, *Pseudomonas aeruginosa*-wild type, *Mycobacterium phlei*, *Saccharomyces cerevisiae*, and *Candida albicans*. MESO are active only one strain of fungi as *Trichophyton mentagrophytes*. MESO are active only when exposed to UV light only one Gram-positive strain of *Staphylococcus aureus*-methicillin sensitive.

### **Cytostatic activity**

Ethanolic extract of *Scindapsus officinalis* in concentration of 200 µg/ml were tested for cytotoxicity on COLO 320 tumour cells, using the microculture tetrazolium (MTT) assay. The IC<sub>50</sub> – value, the concentration causing 50% growth inhibition of the tumour cells, was used as a parameter for cytotoxicity. The extracts of *Scindapsus officinalis* did not show a cytotoxic effect up to 100 µg/ml, the highest concentration tested. The value of IC<sub>50</sub>(µg/ml) of fruit of *Scindapsus officinalis* was found to be 38±1 and Growth inhibition at 100 µg/ml (%) was 93.50.

### **Antiviral activity**

Methanolic extract of fruits were assayed in two in vitro viral systems, influenza virus/MDCK cells and herpes simplex virus/vero cells and IC<sub>50</sub> value was calculated. These extract showed no cytotoxic effects. The IC<sub>50</sub> (µg/ml) was 87 using test system Influenza A/MDCK cells and CC<sub>50</sub> (µg/ml) not measured. The CC<sub>50</sub> (µg/ml) was 33.3 using test system stimulant.

## **CONCLUSION**

This review shows that *S. officinalis* (Roxb.) is an important medicinal plant with diverse pharmacological spectrum. Few novel chemical constituent isolated from *S. officinalis* (Roxb.) showed anticancer, antidiabetic, and antiulcer properties too. Further evaluation need to be carried out on *S. officinalis* (Roxb.) to explore concealed areas and their practical clinical application, which can be used for the welfare of the mankind port in carrying out this study at the laboratory.

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