



A review on Chemical Constituents and Pharmacological Activities of *Sauropus Androgynous*

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ABSTRACT

Our nature is the main source of medicinal plants which having a life saving active phytoconstituents. The usage of medicinal plants for curing a disease has become a therapeutic modality. In Unani literature numerous drugs are mentioned which have immense medicinal properties. Among these, *Sauropus androgynous* is one of the most common perennial shrubs traditionally used in South Asia and Southeast Asia [1]. *Sauropus androgynous* is commonly known as gooseberry belongs to family Phyllanthaceae, can grow in a humid atmosphere [2]. This herb as also been used in Malaysia, Indonesia and in India in cooking as a multivitamin and multigreen plant [3]. The leaves and other parts of this plant have a medicinal importance, which has traditionally been used to promote lactation, for wound healing, to relief urinary disorders and as an antidiabetic [4]. The main purpose of making this review is to get an information about the history, pharmacological studies, uses and other beneficial information regarding the *Sauropus androgynous*.

INTRODUCTION

Sauropus androgynous popularly known as Katuk or Sweet leaf belongs to family Phyllanthaceae [5]. The leaves of this shrub have shown superior nutritive value compared to other leafy vegetables [6]. In India the leaves of this herb have been using in cooking as a vegetable because of its inexpensive source of dietary proteins [3]. The active compounds of *Sauropus androgynous* contains sauroposide which can also be detected i.e., alkaloids, flavonoids, carotenoids, ascorbic acid, glycosides, tannins, saponins, terpenoids, phenols, steroids. It has high level of provitamin A, especially freshly picked leaves are rich in vit C and B, protein and minerals [5]. The decoction of its roots is also been using in nose ulcer and fever. The Leaves and roots of these shrub is also beneficial to cure anaemia, high blood pressure, eye troubles, to blood circulation and for regular bowel elimination. In India the shrub is found to be reported in Sikkim Himalayas, Khasi, Abor, Aka hills and in western ghats of Kerala [7].

Taxonomy:

Synonyms : *Aalius androgyna*, *Phyllanthus strictus*

Botanical name: *Sauropus androgynous*

Kingdom : Plantae

Order : Malpighiales

Family : Phyllanthaceae

Genus : *Sauropus*

Species : *androgynous*

Vernacular names: [6,8]

Kannada : Chakramuni soppu

English : Katuk, sweet leaf

Tamil : Thavasi murunggai

Malayalam : Malay chura, Elacheera

Bengali : Chakurmani

Assamese : Bari Sundari



Fig. 1 : Image of the plant *Sauropus androgynous*

Chinese : Mani cai

Lepcha : Sengtungrung

Habitat and distribution

Sauropus androgynous has an awkward growth habit with long upright stems, can grow best in a shady place. Chakramunis grows rapidly in hot humid condition then becomes relatively dormant in cooler environment [6]. Having a short lateral branch superficially with the appearance of compound leaves. The top stem cutting is the best material for stem cutting which produce the highest root. It tolerates heavy rainfall grows best under the conditions of good fertility and drainage. It is widely found in the tropics of south Asia i.e., India, Srilanka, China and Southeast Asia i.e., Indonesia, Malaysia, Philippines from sea level up to 1300 m altitude [9] and also common in evergreen forest, clearings, scrub, rocky or waste ground and in roadsides.

Botanical description

Sauropus androgynous is a shrub plant that can grow up to 500 cm in height. The leaves of *Sauropus androgynous* bear dark green oval measuring of 5-7 cm long \times 1.5-3.5 cm wide. Leaves are arranged alternately; leaves are single at each node and borne along the stem alternately in an ascending spiral. Flowers are inflorescence axillary, having several male and female flowers per cluster. Branchlets are angular when young then become terret with age [4,7].

Phytoconstituents

The nutritional value of *Sauropus androgynous* is higher than that of other commonly using vegetables. Phytochemical investigation of the leaves of *Sauropus androgynous* contains Glycosides, tannins, saponins, flavonoids, steroids, alkaloids and multivitamins like Vit A, C, B. Fatty acids and their esters have also been identified [7]. Phenolic acids like benzoic acid, ferulic acid, caffeic acid and vanillic acid are identified [2]. *Sauropus androgynous* leaf is one of the nutritious food having high fiber

content [10]. Mineral contents present in Chakramunis leaves are Mg, K, Na, Ca, P, Iron, Zinc, Selenium, Chromium, Cobalt, Vanadium [6]. The FTIR spectrum analysis of *Sauropus androgynous* leaf collected from Indonesia have reported that the plant sample contains Carboxylic acid, Amine salt, CO_2 , Alkene, Sulfone, Amine, Alkyl aryl ether, as common functional groups [2].

Pharmacological activities:

Anti-diabetic activity [11-13]:

Diabetes is chronic disease characterized by increased concentration of glucose in the blood causing a condition known as hyperglycemia, occurs when the body cannot produce enough insulin or cannot use insulin effectively. Diabetes causes abnormalities in the metabolism of lipid and protein. Vit C content was high in raw and cooked *Sauropus androgynous*. The extract of the leaves of *Sauropus androgynous* in oral dose elicited marked reduction in blood glucose level in alloxan induced diabetic mice. The *Sauropus androgynous* extract of both the dose significantly decreased the SGOT, SGPT and VLDL levels and significantly increases in ALP level in alloxan induced diabetic mice compare to that of the normal control mice.

Analgesic, Antipyretic and anti-inflammatory activity [14-15]:

Algesia or pain is an unpleasant subjective sensitive. It is a warning signal and indicates that there is impairment in structural and functional integrity of the body. Inflammation is the body's immune systems response to an irritant. *S. androgynous* is beneficial during the inflammatory response, pain and fever. Phytoconstituent derivatives were found in *S. androgynous* i.e., saponins, tannins, triterpenoids, coumarin associated with Non-steroidal anti-inflammatory drugs (NSAIDS) properties. The extract of *Sauropus androgynous* leaves possesses significant elevation of body temperature in rats. The extract of Katuk leaves has some influence on the prostaglandin biosynthesis since it is

Table 1 : Phytochemical constituents identified from *S. androgynous* extracts.

Classes	Constituents	Method of analysis	References
Flavonoids	Quercetin ^a Myricetin ^a Luteolin ^a Apigenin ^a Kaempferol ^a	HPLC	[23]
Glycosides	Lignan glycosides ^b Megastigmame glucoside ^b Guanosine ^b Corchoionoside ^c	NMR	[10]
Fatty acid	Tetradecanoic acid, ethyl ester ^a Ethyl palmitate ^a Linoleic acid ^a 9,12,15-Octadecatrienoic acid ^a methyl ester ^a 1-Hexadecyne ^a Pyrene ^a	GC-MS	[24,25]
Terpenoid	Phytol ^a Squalene ^a	GC-MS	[26,24,25]
Phenol	Gamma-Tocopherol ^a Vitamin E dl-alpha-tocopherol ^a	GC-MS	[24]
Sterol	9,19-Cyclolanostan-3-ol ^a 23-Ethylcholesta-5,23,28-trien-3. beta-ol ^a	GC-MS	[24]
Other compounds	Ethyl chrysanthemumate ^a cyclopropanecarboxylic acid ^a 3-Buten-2-one ^a 7-hydroxyphenprocoumon ^a 2,5-Pyrrolidinedione ^a	GC-MS	[26,24,25]

^a:identified from the leaves; ^b identified from the shoots; ^c identified from the aerial parts

HPLC: High performance liquid chromatography, NMR: Nuclear magnetic resonance

GC-MS: Gas chromatography-Mass spectrometry.

believing to be a regulator of body temperature. The extract found to possess significant anti-inflammatory effect in ethanolic extract. The studies confirmed that *Sauropus androgynous* leaves could be beneficial in the management of inflammation, pains and fever.

Anti-bacterial activity [16-17]:

Sauropus androgynous is a multivitamin plant rich in vitamins. Antibacterial activity is supported by multivitamins, peptides, glycosides, alkaloids, saponins, terpenoids, flavonoids. Evaluation of antibacterial activity using agar diffusion assay shows that the methanol extract has more antibacterial effect on gram-positive bacteria than ethanol and aqueous extract. Methanol and ethanol extract has exhibited significant antibacterial activity against all the six bacterial strains, while the

aqueous extract showed moderate activity against *Salmonella typhimurium* and *Klebsiella pneumoniae*.

Antioxidant activity [18]

Recent interest has been focused on strategies that could enhance the removal of reactive oxygen species. *Sauropus androgynous* leaves has great natural antioxidant potential such as phenolic compounds, phenolic acids, flavonoids, tannins, carotenoids and vitamins. Analysis of antioxidant activity using DPPH assay confirms that the ethanolic extract of 50% Katuk leaves had the highest antioxidant activity with IC50 value of 88.33ppm, the phenolic and flavonoid contents in Katuk leaves play an important role in its activity as a source of antioxidant. This showed that the ethanol extract of Katuk leaves had a strong DPPH radical scavenging activity.

Table 2 : Medicinal properties of *Sauropus androgynous* and methods of reported activities.

Biological activity	Extract	Name of the compound	Method
Anti-bacterial	Ethanolic leaf extract Methanolic leaf extract	Pyrene Squalene 1-Hexadecyne	Disc diffusion method/Agar diffusion assay
Anti-inflammatory, Analgesic	Ethanolic leaf extract	1-Octadecyne 2(1H) Naphthalenone Azulene	Carrageenan induced paw edema model, Hot-plate test
Antioxidant	Methanolic leaf extract Ethanolic leaf extract Stem extract	Squalene Neophytadiene Cis, cis, cis-7,10,13-Hexadecatrienal Delta-tocopherol Gamma-tocopherol Phytol Methyl ester 9,12,15-octadecatrienoic acid	DPPH assay
Anthelmintic	Methanolic leaf extract	Neophytadiene	Adult Indian earthworm model
Anti-diabetic	Ethanolic and methanolic leaf extract	Phytol	Alloxan induced diabetic model.
Anti-dyslipidemic	Ethanolic leaf extract	Saponins	Fat-rich diet induced model
Lactation enhancer	Ethanolic leaf extract	Papaverine Phytosterol	Expression of genes encoding prolactin and oxytocin were analyzed in lactating mice brains using RT-PCR.
Wound healing	Ethanolic leaf extract	Carotenoids, thiamine, ascorbic acid, toluene and thymol	Excision and incision wound models
Antidiuretic	Ethanolic and methanolic leaf extract	Phytol	-
Antimicrobial	Stem extract	Phytol Methyl ester 9,12,15-octadecatrienoic acid	Broth micro-dilution method
Antifungal	Methanolic leaf extract Ethanolic leaf extract	Neophytadiene 9,12,15-Octadecanoic acid	-
Antiarthritic	Ethanolic leaf extract	9,12,15-Octadecanoic acid	Inhibition of protein denaturation method
Anticancer	Methanolic leaf extract	Phytol	MTT assay
Antiulcer	Methanolic leaf extract	Solanesol	-
Cardioprotective	Ethanolic leaf extract	Gamma-tocopherol	Isoproterenol induced cardiotoxicity model, Invitro model using cardio myoblast cells

Lactation enhancer [19]

Sauropus androgynous believed to increase breast milk production during lactation. Lactation is a process of milk synthesis and secretion with the help of hormones prolactin and oxytocin. The expression of genes encoding prolactin and oxytocin were analyzed in lactating mice brains using RT-PCR. Two groups of lactating mice were fed with diet containing young or mature *S. androgynous* leaf extract. The result proposed that mature *S. androgynous* leaf extracts increased the expression of prolactin and oxytocin genes in lactating mice and was anticipated to correlate with papaverine content.

Anti-dyslipidemic activity [20]

A phytochemical screening of *S. androgynous* leaves proposed that Katuk leaves are also rich in saponin compound. This compound separated from Katuk leaves crude extract by

column chromatography. Male wistar rats were fed with fat rich diet to increase its total cholesterol, triglycerides, LDL level and to decrease HDL level then saponin fraction of Katuk leaves was given to high fat induced rats and its lipid level in blood was measured. As per the analysis of lipid level difference from each group of rats gives a conclusion as saponin fraction of Katuk leaves can become an anti-dyslipidemic and also prevent the cardiovascular disorder in wistar male rats.

Wound healing activity [21]

Carotenoids, thiamine, ascorbic acid, toluene and thymol are promoters of the wound healing process. Carotenoids play a role in maintaining epithelial integrity. Excision and incision wound models were used to evaluate the wound healing activity of *Sauropus androgynous* on wistar rats of either sex. *Sauropus androgynous* extract promoted the wound healing activity

significantly in both wound models studied. Histologic evaluation of wound tissue showed abundant collagenation, fibroblast and lesser macrophages in animal treated with 5% *Sauropus androgynus* when compared to control and ointment base. It is concluded that *Sauropus androgynus* promotes wound healing activity.

Anthelmintic activity [22]

The extract was found to possess vermifuge and vermucidal activity. Preliminary phytochemical analysis detected presence of alkaloids, phytosterols, tannins, flavonoids, saponins and these constituents may be responsible for Anthelmintic activity. The different concentrations of leaf extract of *Sauropus androgynus* were evaluated for anthelmintic activity using adult Indian earthworm model. The extract exhibited a dose dependent inhibition of spontaneous motility. The results indicate that extract possesses vermucidal activity and thus, may be useful as an anthelmintic.

CONCLUSION

This review has widely explained phytochemical properties of *S. androgynus* which is having nutritional value higher than other commonly using vegetables, contains Glycosides, tannins, saponins, flavonoids, steroids, alkaloids, multivitamins like Vit A, C, B, fatty acids, phenolic acids and also rich in mineral contents like Mg, K, Na, Ca, P, Iron, Zinc, Selenium, Chromium, Cobalt, Vanadium. *S. androgynus* has notable pharmacological activities including lactation enhancer, antioxidant, wound healing, antidiabetic, anti-dyslipidemic, anti-inflammatory, analgesic and anthelmintic activities. Although many studies have been conducted to evaluate efficacy of *S. androgynus*, still further studies need to be done to investigate its other medicinal properties.

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