

An overview of pharmacological efficacy and chemical moieties of *Strobilanthes ciliata* Nees.(Acanthaceae)

Abstract - The expensive modern drugs have been replaced by medicinal plants these days. *Strobilanthes ciliata* Nees as called "Sahachara" is mainly used in the Indian system of drug and medicine and has shown biochemical activities that are – anti-microbial, anti-cancerous, anti-inflammatory, analgesic, hepatoprotective, antidiabetic. In ayurvedic preparation roots and leaf of the *Strobilanthes* is a main ingredient which removes of inflammation and pain, compounds such as betulin, lupeol, stigmasterol, stigmasterol glycosides etc. has been reported from the stem extract. The major component present in the plant's various parts is lupeol, which has a broad pharmacological potential. The phytoconstituents or the phytochemicals along with biological activities contribute for the medicinal importance of this plant. This review paper tends to cover information available on various studies of medicinal values and chemical constituents of *S. ciliata* Nees. Nees.

Keywords: Hepatoprotective, Phytochemistry, Lupeol, Analgesic

INTRODUCTION

Genus *Strobilanthes* Blume is a perennial flowering herb or shrub and it is a second largest genus in the family Acanthaceae with 350 species in Tropical Asia out of them 150 species are present in Indian subcontinent. Total 46 species are native to India. In different traditional systems of Indian medicine, many plants are used. Chemical substrates which produce physiological actions inside the human body are the medicinal value of the plant. Medicinal plants are low cost alternative for modern expensive medicine due to which there use has been increased. [2] [4].

Genus *Strobilanthes* Blume contain chemicals or phytochemicals such as flavonoids, phenolics, fixed oils, terpenoids, phytosterols, proteins, saponins, glycosides, carbohydrates, and alkaloids. *Strobilanthes*, stem and leaf show presence of carbohydrates, phenolic, fixed oils, phytosterols, flavonoids, and terpenoids. In all the species of *Strobilanthes*, phytosterols and terpenoids are present. Most of the species of *Strobilanthes* contains flavonoids, phenolics, and carbohydrates. [4]

Acanthaceae family of dicotyledonous flowering plants which have about 250 genera and 4000 species. Due to the presence of phytochemicals Acanthaceae family has high medicinal value. Most species of this family are shrubs, tropical herbs or vines twining few of them are epiphytes. Temperate region contain only few species of this family. [7]

Due to recent results of research carried out in the world, knowledge about properties of medicinal plants is continuously growing all over the world. *Strobilanthes* s Blume pecies can be uses as an alternative to allopathy in many cases. The whole plant of *Strobilanthes* Blume species is recognized as valuable medicine/drug used in ancient – traditional medicine. Only few species of *Strobilanthes* Blume has been studied for their chemical constituents / phytochemicals. [9]

S. ciliata Nees has a strong aroma and has been used in ayurvedic medicine/drug also in Indian medicine system. In ayurvedic preparation plants are important ingredient. The plant has also shown effects on neurological disorders. [13]

The roots of *S. ciliata* Nees are thermogenic, sweet, bitter, diuretic, emollient, diaphoretic, febrifuge, tonic, and expectorant. Its bark and leaf are expectorant, diaphoretic, depurative, and febrifuge. They cure fever, whooping cough, leprosy, leukoderma, inflammation, and pruritis. Its leaves are externally applied on lumbago, gout and joint pain. Leaves are used in treatment of dropsy, jaundice, urinogenital tract and rheumatism. The root, seeds, stem, and leaves of this plant has enormous number of therapeutic effects such as chest congestion, jaundice, bronchitis, odontalgia, diabetics, lumbago, sciatica, limping, diuretic, diaphoretic, and rheumatism treatment [1].

Terpenoids, flavonoids, carbohydrates, phytosterols, and tannins are main phytochemicals present in *S. ciliata* Nees. Phytoconstituents such as flavonoids, flavanols, lipids, and tannins were quantified in *S. ciliata* Nees. Major constituent found in this species is lupeol which exhibit broad spectrum of biological activity like antitumor, antiprotozoal, antimalarial, and anti-inflammatory. [6]



Fig. 1. Morphology of *Strobilanthes ciliata* Nees.(Acanthaceae)

<https://www.flowersofindia.net/catalog/slides/Lesser%20Kurinji.jpg>

Chart 1: Taxonomic classification

Kingdom - Plantae

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Subkingdom - Phanerogamia
 Division - Angiosperm
 Class - Eudicots
 Subclass - Asterids
 Order - Lamiales
 Family - Acanthaceae
 Genus - *Strobilanthes*
 Species - *Strobilanthes ciliatus*

**Figure-Diagrammatic view of
*Strobilanthes ciliatus***

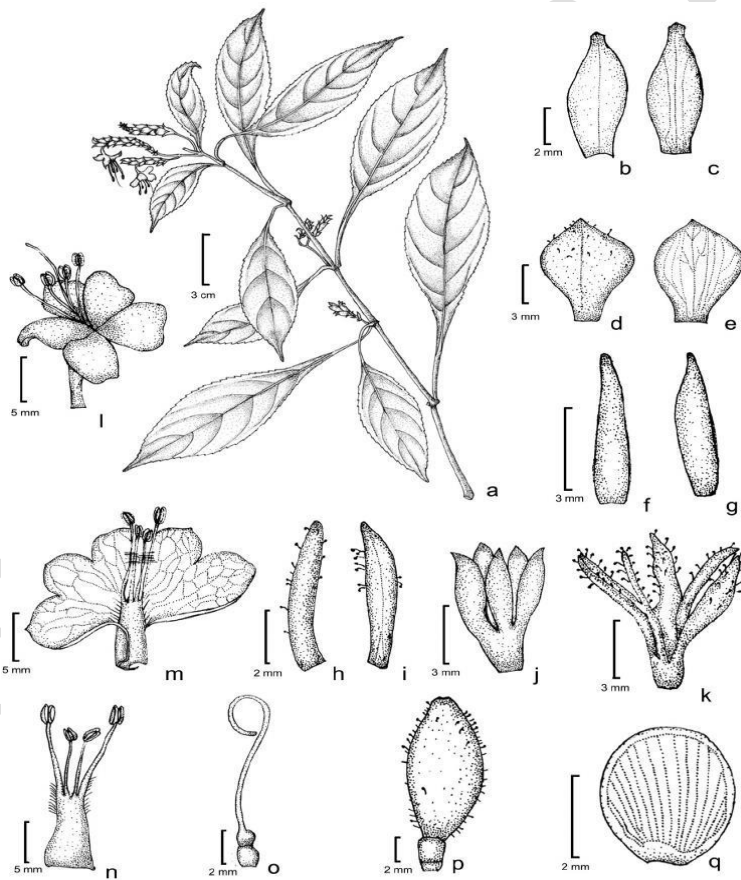


FIGURE 2 – (a) twig with the flower, (b),(c) Flower- bract (ventral and dorsal side), (d),(e) fruit- bract (ventral and dorsal side), (f),(g) flower- bracteole (ventral and dorsal side), (h),(i) fruit- bracteole (

ventral and dorsal side), (j) sepal - flower, (k) sepal - fruit, (l) petal, (m) petal with the stamen, (n) stamen, (o) carpels, (p) Pod/capsule, (q) seed. [14]

General Morphology of *S. ciliata* Nees - Prominent, often fimbriate, nodes jointed, leaves opposite, simple, lanceolate, serrate, attenuate at base, glabrous, apex acuminate. 4 seriate flower, pale or white, purple dense spikes. Capsule are ciliate and oblong. Calyx – 5-6.5 mm long, segments unequal, acute at apex, linear to lanceolate, glabrous, few glandular hair present. This plant produces fruits and blooms (flower) once in a year, during December-March [1].

MEDICINAL ASPECT

Recent investigation out of *Strobilanthes ciliata* Nees proves and supports the pharmacological potential of this plant as anti-inflammatory, antimicrobial, antioxidant, analgesic, anti-diabetic, anti-cancerous by using suitable *in vitro* and *in vivo* methodologies [1].

Anti-Microbial Activity

Strobilanthes ciliata Nees plant also shows antimicrobial activities. Its ethanolic and acetone extract for anti-microbial property, study was conducted with 3 strains of bacteria *Klebsiella pneumonia*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, one fungal strain *Aspergillus* through method of disc diffusion. In this method root and stem extract resulted in activity (medium) against the strains. Chloroform, petroleum, ether, and aq. extract on the leaf of *Strobilanthes ciliatus* was evaluated against various types of fungus and bacteria such as- *S.aureus*, *B.subtilis*, *E.coli* (bacterias); *A.niger*, *C.albicans* (fungus). For the fungal stains *Monascus purpureus*, *Microsporium gypseum* and *Trichophyton rubrum* were used. [3]

Antimicrobial activity was assessed by determination of MIC and disc diffusion by serial dilution methods using clotrimazole- 10mg and ciprofloxacin- 5mg. extracts of petroleum ether showed highest activity against *Corynebacterium*, *Klebsiella*, and *Escherichia coli*. [12]

Antiviral Activity

Chloroform and petroleum ether extract of the *Strobilanthes ciliata* Nees. leaf show antiviral effect towards HSV-I and HSV-II against the 10TCID₅₀, 2TCID₅₀ complex doses. According to this, *Strobilanthes cusia* which belongs to the same genus exhibit good antiviral potential against RNA viruses. Weak antiviral potential is shown by lupeol in many studies. Lupeol has served as a lead drug for ages. In *Strobilanthes cusia* root the lupeol extract isolated shows an ECV₅₀ – 11.7µM against HSV-1 and also shows inhibition (100%) of virus plaque. Betulinic acid has shown better activity against HSV-1, reducing plaque formation, it is known for anti-HIV activity. [1]

Hepatoprotectivity

The methanolic extract of bark of *Strobilanthes ciliata* Nees. show hepatoprotective activity against paracetamol induced toxicity in mice. Dose of about 2.5g/kg of paracetamol was induced orally to damage the liver. The experiment was conducted on animals by segregating them into five groups I, II, III, IV, V. [15]

Significant reduction in levels of SGOT, ALP and SGPT was shown through the Biochemical studies when compared to treatment group and paracetamol control group showed great increase in total serum protein level. [1]

Antidiabetic Activity

To show the antidiabetic activity of *Strobilanthes ciliata* Nees. the alcoholic and aqueous extract of the whole plant used to conduct study on streptozotocin- nicotinamide induced experimental rats. The aqueous solution extract showed lower level of blood sugar when they were judged on the basis of normal rats. Experimental rats were divided into groups and different parameters were used such as oral glucose tolerance, acute toxicity, normoglycemic study was performed before going for antidiabetic screening. Using α -amylase and α -glucosidase inhibition assay evaluated the whole plant for the antidiabetic activity of the ethanolic extract. The experiment showed α -amylase inhibitory activity is less than the α -glucosidase inhibitory activity is high. The mild/lower inhibition of α -amylase and strong/high inhibition of α -glucosidase is an effective treatment for type-2 diabetes. [1]

Strobilanthes ciliata Nees. ethanolic extract inhibition of α -glucosidase is higher than α -amylase inhibitory activity. This confirms that *Strobilanthes ciliata* Nees. show therapeutic effect on type-2 diabetes. [6]

Acute Oral Toxicity Studies

To evaluate the acute toxicity study of the extracts of *Strobilanthes ciliata* Nees. plant was conducted on healthy Wistar albino rats and this experiments results shows no death was seen/reported in the albino rats having about maximum dose of extract with oral route. Results of this experiments showed that the extract had no toxic effect and were safe for *in vivo* use. [1]

Anti-Inflammatory Activity

Experiment (acute toxicity study) was conducted on rats with ethanolic extract of aerial parts of *Strobilanthes ciliata* Nees., a dose of about 2000mg/kg was given for 14 days and no mortality was reported. *Strobilanthes ciliata* Nees. LD50 will be less than 2000mg/kg body weight. [10]

The ethanolic extract of *Strobilanthes ciliata* Nees. shows reduction in carrageenan depending on the dose cause paw edema in the rats. The lower paw edema of rats vol. better was the anti-inflammatory properties. This study showed that *Strobilanthes ciliatus* (ethanolic extract of aerial part) is effect as anti-inflammatory. [5]

Anti-Cancerous Activity

Cytotoxicity of methanolic and acetone extract of *Strobilanthes ciliata* Nees. show great activity against EAC and DLA cells, the amount of dose of extract used is not mentioned. Cytotoxicity of extract of hydroalcoholic extracts of *Strobilanthes ciliata* Nees. was evaluated against the MCF-7 through MTT assay. IC50 value of standard and extract was 3.3 μ g/ml and 3.68 μ g/ml. the study proved that cytotoxicity of extract of *Strobilanthes ciliata* Nees. show anti-cancerous activity. [5]

Analgesic Activity

Analgesic activity (*in vivo*) was conducted on plant extracts of *Strobilanthes ciliata* Nees. through the method- tail clip. Dose- 100-200 mg/kg were used/evaluated against pentazocine dose – 5 mg/kg. Experiment conducted resulted in inhibition of tail clipping at different time intervals depending upon the dose, after 30 min increase in biting of tail clip mean latency was observed. The activity proved the analgesic property of the *Strobilanthes ciliata* Nees. plant. [5]

Antioxidant Activity

With the help of *in vitro* radical scavenging assay, antioxidant activity of *Strobilanthes ciliata* Nees. leaf ethanolic extract was evaluated. The assay showed inhibition of DPPH activity depending on the dose with IC₅₀ – 47.11µg/ml comparing to ascorbic acid IC₅₀ – 50.11µg/ml. The *in vitro* assay at a dose of 100µg/ml at a dose depending manner also showed radical superoxide scavenging activity. The results show antioxidant activity from the ethanolic leaf extracts of the plant. [5]

DNA Protective Effect

Comet assay showed that *Strobilanthes ciliata* Nees ethanolic leaves extract against H₂O₂ reduced DNA damage in lymphocytes (cultured). In the experiment four groups of cells were there group I-0.05% DMSO, II-500µg/ml H₂O₂, III- pre-treated with 60µg/ml of extract and 500µm H₂O₂, IV-60µg/ml of extract. The DNA damage caused by administering H₂O₂ was very low in cultured lymphocytes which was pre-treated with 60µg/ml- ethanolic leaves extracts. [1]

PHYTOCHEMICAL ASPECT

The phytochemical contents in *Strobilanthes ciliata* Nees. showed presence of various components of different types of chemical constituents such as lipids, tannins, flavonoids, flavanol, terpenoids, phytosterols, and carbohydrates etc. [8]

On the ethanolic leaf extract of *Strobilanthes ciliata* Nees GC-MS analysis was conducted the result showed presence of various chemical moieties in the extract of the plant. Lupeol which is a steroid and terpenoid, butelin, stigmasterol glycoside, stigmasterol was reported through, stem acetone extracts. [5]

FOURIER TRANSFORM INFRA-RED SPECTROSCOPY (FTIR)

FTIR peak values and functional groups in methanol extract of *Strobilanthes ciliata* Nees. showed the presence of functional group such as aryl alkyl ethers, sulfate, alkane, silane, amine, carboxylic acid, alkyne, amides, ketone, lactans, aldehyde. Phytoconstituents present in the leaves of *S. ciliata* Nees if subjected to biological activity will give effective results for treatment of many ailments. The presence of functional groups could be responsible for various medicinal properties of *S. ciliata* Nees. FTIR analysis is useful for the identification of bioactive compounds present in plant extracts. [11]

CONCLUSION

This review paper focuses on the chemical constituents and medicinal value of *Strobilanthes ciliata* Nees.. Present review shows scientific studies carried on this *S. ciliata* Nees. for its worldwide popularity for its medicinal uses in ayurvedic, traditional ancient medicinal system and therapeutic effect. *S. ciliata* Nees. has shown anti-inflammatory, antimicrobial, antioxidant, analgesic, antidiabetic, anti- cancerous properties. The bark and leaf of *S. ciliata* Nees. are expectorant, diaphoretic, depurative, and febrifuge. They cure fever, whooping cough, leprosy, leukoderma, inflammation, and pruritis. The leaves of *S. ciliata* Nees. are externally applied on lumbago, gout and joint pain. Leaves of this plant are used in treatment of dropsy, jaundice, urinogenital tract and rheumatism. Various experimental results confirm *S. ciliata* Nees as a valuable source for various chemical compounds such as lipids, tannins, flavonoids, flavanol, terpenoids, phytosterols, and carbohydrates etc. This review paper gives a brief view on the phytochemical aspect and the medicinal efficiency of *S. ciliata* Nees plant and may also be helpful for future development of medicine/drug from the plant.

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