

PHYTOCHEMICAL ANALYSIS OF STROBILANTHES BLUME SPECIES FROM NORTHERN WESTERN GHATS OF INDIA

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ABSTRACT

Objective: The chief phytoconstituents in ten *Strobilanthes* species of both leaf and stem were identified in order to relate the presence of biological and pharmacological activities.

Methods: *Strobilanthes* species were collected from Northern Western Ghats of India and phytochemicals such as alkaloids, carbohydrates, glycosides, saponins, proteins, phytosterols, terpenoids, fixed oils, phenolics and flavonoids were analyzed using standard methods.

Results: *Strobilanthes* species of both leaf and stem showed the presence of terpenoids, flavonoids, phytosterols, phenolic compounds, fixed oils and carbohydrates. Terpenoids and phytosterols are also present in all species of *Strobilanthes*. On the other hand, phenolics, carbohydrates, flavonoids are found in most of the species of *Strobilanthes*. In addition, alkaloids, glycosides, saponins, proteins, fixed oils are found in some species of *Strobilanthes*. Among the species studied, the stem of *S. integrifolius*, *S. ixiocephalus*, *S. reticulatus* var. *reticulatus*, *Strobilanthes* Blume sp. and leaf of *S. lupulinus*, *S. barbatus* showed the absence of alkaloids. Glycosides were present only in *S. ciliatus* (leaf), *S. callosus* (stem) and *S. heyneanus* (stem). Saponins were found in *S. ciliatus* (leaf), *S. ixiocephalus* (leaf, stem), *S. callosus* (leaf) and leaf and stem of *S. heyneanus*. Proteins were found only in the stem of *S. callosus* and *S. sessilis* var. *ritchii*. Fixed oils also known as carrier oils were moderately found in the *Strobilanthes* species.

Conclusion: Thus, the detection of phytochemical constituents in ten *Strobilanthes* species is important in interpreting the medicinal properties and pharmacological value of the species.

Keywords: Pharmacological value, Phytochemical constituents, *Strobilanthes* species

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INTRODUCTION

Strobilanthes belongs to Acanthaceae and the second largest genus of this family. It comprises of approximately 300 species in tropical Asia. The Indian subcontinent has nearly 150 species, out of which 59 are seen in peninsular India. The genus is not greatly explored for economic utility. *Strobilanthes ciliatus* is one of the endemic and potential medicinal plants. It is widely used in Ayurveda as a source of the drug 'Sahacharya' [1]. Western Ghats of India serves as a rich repository of medicinal plants. *Strobilanthes* species are known for its several medicinal properties.

Extraction of phytochemicals using the standardized solvent based system provides the list of wide range of chemical constituents in medicinal plants. This can also help in the comparative analysis of compounds present in the different plant organ and also in the related species. The traditional utilization of medicines directly from the plant organ is not advisable because other than the bioactive compounds, it also contains a mixture of several other compounds. Understanding the purity and stability of the active compound is very essential in pharmacognostic studies [2]. Hence, the present study was undertaken to analyze the phytochemical constituents in ten *Strobilanthes* species from Northern Western Ghats of India.

MATERIALS AND METHODS

Plant materials

A total of 10 species of *Strobilanthes* were collected from different parts of Northern Western Ghats of India. The scientific name, common name, and place of the collection are provided table 1.

Preparation of extracts

Plant material collected from the field were washed under the tap water 2-3 times until the soil particles are removed. Fresh and healthy leaf and stem material were put for drying under the shade. After, two weeks when the samples are fully dried, they were

powdered using a grinder. One gram of leaf and stem powder of each *Strobilanthes* species were weighed using an electronic balance. The sample was then extracted with 10 ml of methanol. The extracts were condensed to 1/10th of volume by heating at 50-60°C in a water bath and then it was filtered using Whatman filter paper no.1. The filtrate was centrifuged at 2500 rpm for 15 min and the supernatant was collected in sterile bottles [3].

Phytochemical tests

Phytochemical analysis of 10 species of *Strobilanthes* for various chemical constituents was carried out using standard methods, and detailed protocol is given below [3-4].

Test for alkaloids

Small aliquots of methanolic extract were stirred separately with few drops of dilute HCl and filtered. The presence of alkaloids was detected by treating the filtrate with Wagner's reagent to confirm the presence of alkaloids in the sample with reddish-brown precipitate.

Test for carbohydrates

To 2 ml of filtrate, two drops of an alcoholic solution of alpha-naphthol are added, the mixture is shaken well, and 1 ml of concentrated sulphuric acid is added slowly along the sides of the test tube and allowed to stand. A violet ring indicates the presence of carbohydrates.

Test for glycosides

50 mg of the extract is hydrolyzed with concentrated hydrochloric acid for 2h on a water bath, filtered. 2 ml of filtered hydrolysate, 3 ml of chloroform is added and shaken, chloroform layer is separated and 10% ammonia solution is added to it. Pink colour indicates the presence of glycosides.

Test for saponins

2 ml of filtrate is diluted with 5 ml distilled water. The suspension is shaken in a graduated cylinder for 15 min. A two cm layer of foam indicates the presence of saponins.

Table 1: List of *Strobilanthes* Blume species with their common name and place of collection

Scientific name	Common name	Place of collection
<i>Strobilanthes ciliatus</i> Nees	Karim Kurinji (Malyalum)	Bondla, Goa
<i>Strobilanthes integrifolius</i> (Dalzell) Kuntze	Waiti (Konkani)	Bondla, Goa
<i>Strobilanthes ixiocephalus</i> Benth	Pitkarvi (Kannada)	Bondla, Goa
<i>Strobilanthes callosus</i> Nees	Karvi (Marathi)	Ambolim, Maharashtra
<i>Strobilanthes reticulatus</i> Stapf var. <i>reticulatus</i>	Gulla karva (Marathi)	Mahabaleshwar, Maharashtra
<i>Strobilanthes sessilis</i> Nees var. <i>ritchei</i>	Bukra (Marathi)	Ambolim, Maharashtra
<i>Strobilanthes heyneanus</i> Nees	Akra (Marathi)	Ambolim, Maharashtra
<i>Strobilanthes</i> Blume sp.	-	Ambolim, Maharashtra
<i>Strobilanthes lupulinus</i> Nees	-	Ambolim, Maharashtra
<i>Strobilanthes barbatus</i> Nees	Suruli mammuni (Malyalum)	Nagargao, Goa

Test for proteins

2 ml of filtrate is treated with one drop of 2% copper sulphate solution. To this, 1 ml of ethanol (95%) is added, followed by an excess of potassium hydroxide pellets. Pink color in the ethanolic layer indicates the presence of Proteins.

Test for phytosterols

The extract (50 mg) is dissolved in 2 ml acetic anhydride. To this, one or two drops of concentrated sulphuric acid are added slowly along the sides of the test tube. An array of color changes shows the presence of phytosterols.

Test for terpenoids

1 ml of extract, to this 2 ml of chloroform is added, and the content is shaken well. Now, an equal volume of concentrated sulphuric acid is added to the test tube. Yellow to brick red color indicates the presence of terpenoids.

Test for fixed oils

A small quantity of extract is pressed between two filter papers. Oil stain on the paper indicates the presence of fixed oils.

Test for phenolic compounds

2 ml extract, to this few drops of neutral 5% ferric chloride solution is added. A dark green color indicates the presence of phenolic compounds.

Test for flavonoids

The extract is treated with 10% ammonium hydroxide solution. Yellow fluorescence indicates the presence of flavonoids.

RESULTS AND DISCUSSION

The phytochemical analysis often *Strobilanthes* species have been carried out, and the results of the same is summarized in table 2, 3. The study revealed the presence of phytochemicals, which are known to possess the active medicinal chemical constituents. The predominant medicinal phytochemical constituents are terpenoids, flavonoids, phytosterols, phenolic compounds, alkaloids, fixed oils and carbohydrates in *Strobilanthes* species.

S. ciliatus stem and *S. integrifolius* leaf extract showed the presence of similar phytoconstituents i.e. terpenoids, flavonoids, phytosterols, fixed oils, phenolics, carbohydrates and alkaloids. *S. ciliatus* leaf and *S. heyneanus* stem showed the absence of proteins in the extract. The leaf extract of *S. lupulinus* and *S. barbatus* tested the similar phytoconstituents exhibited the presence of carbohydrates, phytosterols, terpenoids, fixed oils, phenolics and flavonoids. Similarly, *S. lupulinus* stem and *S. barbatus* stem extract showed a related group of phytoconstituents.

The study revealed the substantial amount of phytochemicals like terpenoids, phytosterols, flavonoids and some percent of alkaloids are present in both leaf and stem of *Strobilanthes* species. The research work was carried out in the 10 species of *Strobilanthes*, having varied phytochemicals present in them i.e. terpenoids, flavonoids, phytosterols, phenolic compounds, fixed oils, carbohydrates. These secondary metabolites contribute significantly towards the biological activities such as anti-inflammatory anti-oxidant, anti-osteoarthritis, analgesic activities, anti-diabetic, anti-microbial and hepatoprotective [5-6].

Leaf and stem of all the 10 species of *Strobilanthes* possess terpenoids. The elements of terpenoids, like triterpenoids are involved in the healing of inflammatory disorders, treat arthritis, anti-tumour properties and antimicrobial activities. Traditionally over the ages, the tribal's have used the plant for the treatment of inflammatory disorders. This confirms its use in folk medicine as a valid anti-inflammatory and antimicrobial herbal drug [7-8]. Flavonoids are also present in all *Strobilanthes* species as a potent antioxidant and free radical scavenger, prevent oxidative cell damage, have strong osteoarthritic activity and analgesic activity [5-6]. In addition, triterpenoids like 'Lupeol' are pharmacologically active and are having potential medicinal properties. It is having a complex pharmacology and has anti-protozoal, anti-microbial, anti-inflammatory, antitumour and chemopreventive properties [9] and lupeol is reported to be present in *Strobilanthes ciliatus* and *Strobilanthes callosus* [10, 11].

Interestingly, terpenoids were present in all *Strobilanthes* i.e. both leaf and stem indicating thereby its high medicinal value. Dietary phytosterol are known to direct oxidation and serum lipids and thus effective against cancer [12]. Surprisingly, phytosterols are being found in the extract of *Strobilanthes* of both leaves as well as in stem.

Table 2: Phytochemical analysis of leaf and stem of *Strobilanthes* species

Phytochemicals	Test	S1		S2		S3		S4		S5	
		L	S	L	S	L	S	L	S	L	S
Alkaloids	Wagner's	+	+	+	-	+	-	+	+	+	-
Carbohydrates	Molish's	+	+	+	+	+	+	+	+	-	+
Glycosides	Borntrager's	+	-	-	-	-	-	-	+	-	-
Saponins	Foam	+	-	-	-	+	+	+	+	-	-
Proteins	Biuret	-	-	-	-	-	-	-	+	-	-
Phytosterols	Libermann-Burchard's	+	+	+	+	+	+	+	+	+	+
Terpenoids	Salkowski	+	+	+	+	+	+	+	+	+	+
Fixed Oils	Spot	+	+	+	+						
Phenolics	Ferric chloride	+	+	+	-	-	+	+	+	+	+
Flavonoids	Alkaline reagent	+	+	+	+	+	-	+	+	+	+

L = Leaf, S = Stem, S1 = *Strobilanthes ciliatus*, S2 = *Strobilanthes integrifolius*, S3 = *Strobilanthes ixiocephalus*, S4 = *Strobilanthes callosus*, S5 = *Strobilanthes reticulatus* var. *reticulatus*. (+) = indicates presence of phytochemicals and (-) = indicates absence of phytochemicals.

Table 3: Phytochemical analysis of leaf and stem of *Strobilanthes* species

Phytochemicals	Test	S6		S7		S8		S9		S10	
		L	S	L	S	L	S	L	S	L	S
Alkaloids	Wagner's	+	+	+	+	-	+	-	+	-	+
Carbohydrates	Molish's	+	+	+	+	+	+	+	+	+	+
Glycosides	Borntrager's	-	-	-	+	-	-	-	-	-	-
Saponins	Foam	+	-	+	+	-	-	-	-	-	-
Proteins	Biuret	-	+	-	-	-	-	-	-	-	-
Phytosterols	Libermann-Burchard's	+	-	+	+	+	+	+	+	+	+
Terpenoids	Salkowski	+	-	+	+	+	+	+	+	+	+
Fixed Oils	Spot	-	-	+	+	+	-	+	+	+	+
Phenolics	Ferric chloride	-	-	+	+	+	+	+	-	+	-
Flavonoids	Alkaline reagent	+	+	+	+	-	+	+	+	+	+

L = Leaf, S = Stem, S6 = *Strobilanthes sessilis* var. *ritchei*, S7 = *Strobilanthes heyneanus*, S8 = *Strobilanthes* Blume sp. S9 = *Strobilanthes lupulinus*, S10 = *Strobilanthes barbatus*. (+) = indicates presence of phytochemicals and (-) = indicates absence of phytochemicals.

Local species of *Strobilanthes* are used by the traditional people to cure different types of diseases. In North-east India, Manipur is accumulate the inflorescence of *S. auriculata* and cook it in condiments or steam with indigenous small fish curry (*Gnatokpo thonoba*), to boost resistance towards the cardiovascular diseases. Hence, this species is a medicinally important plant for the people of Manipur [13]. Plant polyphenolic compounds long-term utilization is known to defend against the growth of cancers, diabetes, osteoporosis, cardiovascular and neurodegenerative diseases [14]. Similarly, potent dietary fibers such as celluloses, hemicelluloses, non-digestible oligosaccharides protect human health from bowel disorders, decrease the risk of coronary heart disease and so on when occupied through diets [15]. In the present study, 10 *Strobilanthes* species screened for the secondary metabolites, phenolic compounds and carbohydrates were found in most of the species of *Strobilanthes*, owing its medicinal importance.

Furthermore, alkaloids, glycosides, saponins, proteins, fixed oils are found varied in the species of *Strobilanthes*. Among all species, *S. integrifolius* stem, *S. ixiocephalus* stem, *S. reticulatus* var. *reticulatus* stem, *Strobilanthes* Blume sp. leaf, *S. lupulinus* leaf and *S. barbatus* leaf showed the absence of alkaloids. Plants containing glycosides are known to apply a beneficial action on the immune system by increasing body strength and therefore are valuable as dietary supplements. Glycosides were present only in *S. ciliatus* leaf, *S. callosus* stem, *S. heyneanus* stem. Saponins were seen in *S. ciliatus* leaf, *S. ixiocephalus* and *S. callosus*, leaf and both leaf and stem of *S. heyneanus*. They are known to promote dietary supplements and nutraceuticals. Proteins have significant allegation into unfolding and degradation activity and also in cell functioning when activating on the targets of free radicals [16]. It was found only in the stem of *S. callosus* and *S. sessilis* var. *ritchei* stem. Fixed oils also known as carrier oils were moderately found in the *Strobilanthes* species; they carry traces of vitamins and minerals. They consecutively may be involved in the antimicrobial activity. Thus, the present study provides the phytochemical constituents present in ten species of *Strobilanthes*, the medicinal properties and the pharmacological activities further could be explored.

CONCLUSION

Phytochemical screening of 10 species of *Strobilanthes* of both leaf and stem revealed the presence of phytoconstituents i.e. terpenoids, flavonoids, phytosterols, phenolic compounds, fixed oils, carbohydrates. It is reported to possess an array of biological and pharmacological activities that include anti-inflammatory, antioxidant, anti-osteoarthritis, anti-diabetic, anti-microbial, etc. These activities are due to the presence of the above mentioned secondary metabolites. The traditional people uses these species without any knowledge. However, these traditional knowledge has been passed on to several generations. These plants are also mentioned in the ethnobotanical studies, ayurveda system of medicines, but it is very much important to survey and explore the potential of the genus. Further, with regard to the development of the quality herbal medicine isolation, characterization, standardization, mechanism of action as well as the clinical trials of the compounds are needed. Considering the above facts, it is concluded that the several species

of the Genus *Strobilanthes* can be of potential for development of pharmaceutically important drugs.

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CONFLICT OF INTERESTS

Declare none

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