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Phytochemical screening and GC-MS analysis of petroleum ether extract of Strobilanthes Ciliatus leaves

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Abstract
Strobilanthes ciliatus is a plant of ethno botanical importance and belongs to the family acanthaceae. The plant is widely used in folklore medicine. The present study was designed to carry out the preliminary phytochemical screening of various extracts from leaves and to identify the phytoconstituents present in the petroleum ether extract by GC – MS analysis. 20 Phyto components were detected in the petroleum ether extract of strobilanthes ciliatus. The phyto components present are mainly terpenoids and steroids. This preliminary study gives an idea to isolate the major active constituents present in the plant and also helps to develop pharmacologically active compounds.

Keywords: strobilanthes ciliatus, phytochemical screening, phytosterols. GC-MS analysis

Introduction

Strobilanthes ciliatus is a medicinally important herb belonging to the family acnthaceae. The plant contains a number of secondary metabolites and posess various pharmacological actions [1]. Traditionally, the plant is used for the treatment for rheumatoid arthritis, lower back pain, sciatic neuritis, walking difficulty, bronchitis, strangury fever, vitiligo, skin infections, inflammation, cough, bronchitis, tooth pain and general weakness. The leaves and bark are diaphoretic, expectorant, depurative and febrifuge, and are useful in a wide variety of medical conditions such as whooping cough, dropsy, leukoderma, leprosy, pruritus, inflammation, scrofula and fever. The leaves are used topically in gout, lumbago and pain in joints.

The roots found to be bitter, sweet, thermogenic, emollient, diuretic, febrifuge, diaphoretic, depurative, expectorant and tonic [2] Seeds are used in the treatment of jaundice, dropsy, rheumatism, disease of Genito urinal tract and against gonorrhoea and spermatorrhea [1] The plant is widely used in the formulation of ayurvedic, siddha and unani medications. For e.g., Sahachara, an ayurvedic preparation contains Strobilanthes ciliatus. This medicine is well recommended by 'Sahasrayogam' for relieving pain especially low back pain, lumbar spondylitis and sciatic. Karimkuringhi is also believed to be used in other Indian systems of medicine such as Unani and Sidha [3, 4]

Karimkuringhi is also mentioned for the treatment of neurological problems. Neuton capsule manufactured by K.S Warrier's Ashtanga Ayurvedics) contains strobilanthes ciliatus and is used as neurotonic for various neurological disorders [1].

Kurinjhi kuzhambu is another medicinal preparation given for woman after delivery for good health [5].

Taxonomical Classification

Kingdom: Plantae
Phylum: Tracheophyta
Class: Mangoliopsida
Order: Lamiales
Family: Acanthaceae
Genus: Strobilanthes
Species: Strobilanthes ciliatus

Synonyms

- Nilgirianthus ciliatus (Wall. ex Nees) Bremek.
- Nilgirianthus warreensis (Dalz.) Bremek.
- Ruellia ciliata Wall.
- Strobilanthes parviflorus Bedd.
- Strobilanthes warreensis

Vernacular Names

Cherukurunji, Chinnikurunji, Karimkurinji, Kurunji, Vellakurunji

Fig 1: Strobilanthes ciliatus

Materials and Methods

Collection of the plant

The plant Strobilanthes ciliatus (Figure 1) was collected from Pala, Kottayam district, Kerala. The plant was authenticated at Botanical Survey of India, Coimbatore with voucher no.BSI/SRC/5/23/2021/tech/258

Chemicals and reagents

All the chemicals and reagents were procured from certified suppliers and of analytical reagent grade.

Preparation of the extracts

The plant extracts were prepared following the procedure of K. Gopal asathees kumar by Soxhlet extraction method [6] The leaves of the plant were dried under shade and was ground to a powder using an electrical blender. Extraction was done by continuous hot percolation method by using the following solvents in order i.e., Petroleum ether, Chloroform, Acetone and Methanol. The extracts were then concentrated using a rotary evaporator and kept at 4ºC until used. Phytochemical screening was done on these extracts.

Phytochemical screening

Phytochemical analysis of petroleum ether extract of Strobilanthes ciliatus was carried out as per standard procedures [7, 8]

GC MS analysis

GC-MS analysis was done on the petroleum ether extract of leaves of Strobilanthes ciliatus. The results of GC – MS analysis is shown in Table 2. Shimadzu GC – MS (Model Number: QP2010S) instrument with GC – MS solutions software was used for analysis. The oven temperature is maintained at 280ºC at a rate of 5ºc/min. Elite - 5MS column of 30m length, 0.25mmID and 0.25micrometer thickness was used.

Results and Discussion

The phytoconstituents present in the extracts were qualitatively analyzed using chemical tests. Phytochemical analysis of the four extracts of Strobilanthes ciliatus showed the presence of glycosides, steroids, triterpenoids, flavonoids, phenolic compounds and tannins (Table 1).

Table 1: Phytochemical screening

SI No	Plant Constituent	PEE	CE	AE	ME
1.	Alkaloids	-	-	-	-
2.	Glycosides	-	-	-	+
3.	Steroids and triterpenoids	+		+	+
4.	Flavanoids	-	-	-	+
5.	Carbohydrates	+			-
6.	Phenolic compounds and tannins	+	-	-	+
7.	Proteins	-	-	-	-
8.	Saponins	-	-	-	-
9.	Fixed oils and fats	-	-	-	-

Detection of phytoconstituents present in the petroleum ether extract of Strobilanthes ciliatus was based on the comparison of mass spectra of samples through national Institute Standard and Technology (NIST II) and Wiley 8 library. Parameters such as comparison of peaks and retention time, computer matching and the characteristic fragmentation patterns of mass spectra were used for characterizing the phytoconstituents. GC-MS profile of the compounds identified is given in Fig 2.

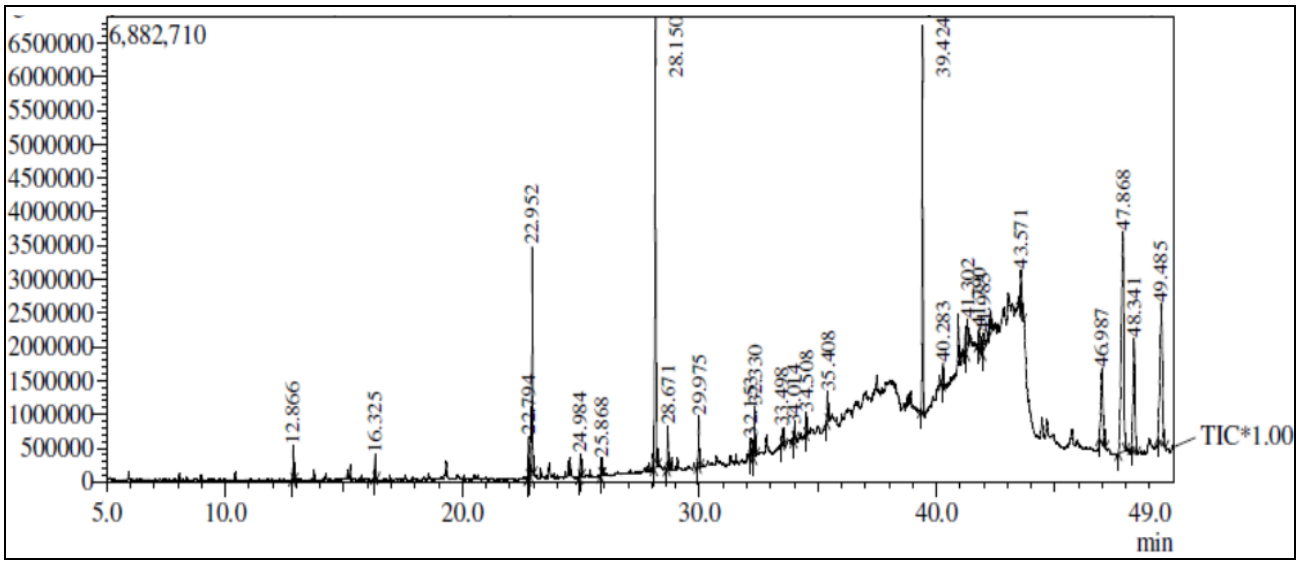

Fig 2: GC-MS Chromatogram

Table 2: GC-MS report

Peak	Retention time	Area	Area%	Name	Base m/z
1	12.866	1101683	0.92	Pentacosane	57.05
2	16.325	898613	0.75	2(4H)-Benzofuranone, 5, 6, 7,7a-tetrahydro-4,4,7a-trimethyl-	111.05
3	22.794	1937352	1.62	Phytol acetate	68.05
4	22.952	8542967	7.14	2-pentadecanone, 6, 10, 14-trimethyl-	58.05
5	24.984	804579	0.67	Isophytol	71.05

6	25.868	579067	0.48	Hexadecanoic acid, ethyl ester	88.05
7	28.150	18944754	15.84	Phytol	71.05
8	28.671	1651702	1.38	Palmitaldehyde, diallyl acetal	84.05
9	29.975	1903110	1.59	Isophytol, acetate	68.05
10	32.153	1316107	1.10	3-methyl-5-(2,6-dimethylheptyl)-1, 5-Pent-2-enolide	111.10
11	32.330	1910491	1.60	4, 8, 12, 16-Tetramethylheptadecan-4-olide	99.05
12	33.498	541534	0.45	Tridecanal	57.05
13	34.014	548472	0.46	3, 4, 8-trimethyl-2-nonenal	98.05
14	35.408	1172367	0.98	1, 2-benzenedicarboxylic acid	149.00
15	39.424	15597033	13.04	Squalene	69.05
16	41.790	1036977	0.87	Nonadecane	57.05
17	41.983	1424379	1.19	Neryl linalool isomer	69.05
18	46.987	6421328	5.37	Campesterol	55.00
19	47.868	24442104	20.43	Stigmasterol	55.05
20	49.485	14605990	12.21	betasitosterol	55.05

GC- MS analysis of petroleum ether extract of leaves of Strobilanthes ciliatus revealed the presence of terpenes (Megastigmatrienone, Phytol). Pentacosane is part of the female sex pheromone of the bee [9]. Benzofuranone compounds are present in many natural products and posess significant antioxidant activity [10]. Phytol is diterpene, a member of the group of branched chain unsaturated fatty alcohols. It is the product of chlorophyll metabolism of plants [11]. Phytol has vast biological activities including anti-inflammatory, antimicrobial, cytotoxic, neuro protective, anti diabetic and antioxidant [12] and breast cancer specifically [13, 14, 15]. Studies reveal that phytol has potential anxiolytic, metabolism-modulating, cytotoxic, antioxidant, autophagy-and apoptosis-inducing, anti nociceptive, anti-inflammatory, immune-modulating, and antimicrobial effects [16].

2-Pentadecanone is a ketone, present in several different foods, such as cereals, fruits, milk and milk products, cauliflowers and asparagus. 2-pentadecanone can serve as potential biomarker for the intake of these foods. The compound is isolated from hop, coconut and other oils and is also found in asparagus, ginger, wheat bread, soybean, cooked rice and cheese [17].

Isophytol is terpenoid in nature and is present in essential oils of plants [18]. Hexadecenoic acid ethyl ester has wound healing activity, hemolytic, pesticide, flavour and antioxidant activities [19].

Squalene is used as emollient in the skincare products and is also known to possess antioxidant and antitumour properties [20, 21]. Squalene is a triterpene. Squalene has antioxidant property on heart and epithelial tissues [22, 23]. Squalene alone or in combination with hypocholesterolaemia drugs, such as statins, promotes both the down-regulation of HMG-CoA reductase, a key enzyme in cholesterol biosynthesis, and the cholesterol and bile acid excretion. Squalene has a positive role I lowering hypertension [24].

4, 8, 12, 16-Tetramethylheptadecan-4-olide posess antibacterial, antioxidant, antitumor, cancer preventive, immune stimulant, chemo preventive and lip oxygenase-inhibitor activities [25]. 1, 2-Benzenedicarboxylic acid, and diethyl ester was used in plasticizers. 1, 2-Benzenedicarboxylic acid reduces oxidative stress and able to cure neurodegenerative disorders [26]. Nonadecane is a volatile heterocyclic hydrocarbon and posess antioxidant activity [27].

Campesterol is a member of phytosterols. It is characterized by the hydroxyl group in position C-3 of the steroid skeleton, and saturated bonds throughout the sterol structure, with the exception of the 5-6 double bond in the B ring [28]. Stigmasterol - is one of the most abundant plant sterols, having a major function to maintain the structure and integrity of cell membranes. Betasitosterol is a plant sterol ester. Beta-sitosterol is a plant substance similar to cholesterol. It might help reduce cholesterol levels by limiting the amount of cholesterol that is able to enter the body. β-sitosterol is being studied for its potential to reduce benign prostatic hyperplasia (BPH) and blood cholesterol levels [29].

Conclusion

GC-MS analysis of the petroleum ether extract of Strobilanthes ciliatus revealed the presence of various bioactive constituents having antioxidant, anti-inflammatory, anticancer and immune stimulant activities. Isolation of individual phyto constituents and subjecting it to biological activity will give promising results. Therefore, the plant can be considered as a source of lead compounds for the synthesis of newer therapeutic agents.

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