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GC-MS Analysis of Ethanolic Extract of *Pteridium Aquilinum* (L.) Kuhn: An Important Fern

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ABSTRACT

The aim of the study was to investigate the phytochemical compounds of ethanol extract of *Pteridium aquilinum* (L.) Kuhn using GC-MS analysis. In GC-MS analysis, 19 bioactive phytochemical compounds were identified in the ethanolic extract of *Pteridium aquilinum* (L.) Kuhn the components were identified by using Perkin-Elmer Gas Chromatography–Mass Spectrometry, the results of GCMS compounds in the extract was relevant to the National Institute of Standards and Technology (NIST) library. The major constituents were decane (12.1%), 1,3,7-Octatriene, 3,7-dimethyl (26.42%) and Limonene (10.89%).

Keywords: Bioactive compounds, Pteridophytes, GC-MS, *Pteridium aquilinum,* NIST

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INTRODUCTION

Ferns are any one or more of a group of about 12,000 species commonly known as Cryptogamic embryophytic vascular plants and come under pteridophytes. They have stem, root and leaves like other vascular plants. Ferns are being an important part of the flora of a region from the next important part after the angiosperms. The world flora consists of approximately 12,000 species of ferns of which around 1000 species distributed into 192 genera and are likely to occur in India. The Western Ghats is one of the hotspots of the world and also one of significant geographical regions. Around 233 species of ferns occur in Southern India[1,2].

Many medicinal plants have proved to successfully aid in various ailments leading to mass screening for their therapeutic components. Ferns also showed pharmaceutical ability and many of them are being used therapeutically[3]. Today, the search for natural compounds rich properties is escalating due to their medicinal importance in controlling many diseases. Phytochemicals are naturally occurring chemical, biologically active compounds found in plants, which are responsible for health benefits for humans further these recognized to micronutrients and macronutrients[4]. Ferns show various economic values towards food and fodder indicators, biofertilizers, insect repellents, medicine and folk medicines. This traditional claim prompted many researchers to investigate on its pharmacological values that include among others, its phytochemical composition and bioactivities[5]. In recent years GC-MS studies have been increasingly applied for the analysis of medicinal plants as this technique has proved to be a reliable method for the analysis of non-polar components and volatile essential oil, fatty acids, lipids and alkaloids[6,7]. Therefore, the aim of the present study was to analyse the chemical composition using GC-MS in the ethanol extract of *Pteridium aquilinum* (L.) Kuhn.

MATERIALS AND METHODS

Collection of Plant Sample

The plant materials used in the present study was *Pteridium aquilinum* (L.) Kuhn belonging to the family Dennstaedtiaceae. The plant materials for the present study were collected from Kothiyar, located in Kanyakumari district, Tamil Nadu, India, during the month of August, 2018

and identified and confirmed by Pteridophyte flora of the Western Ghats - South India[1].

Preparation of extracts

For the preparation of ethanol extract, the plant specimens were washed thoroughly and placed on blotting paper and spread out at room temperature in the shade condition for drying. The shade dried samples were grounded to fine powder using a tissue blender. The powdered samples were then stored in the refrigerator for further use. 30g powdered samples were packed in Soxhlet apparatus and extracted with ethanol for 8h separately[8].

Gas Chromatography-Mass spectrometry (GC-MS)

The GC-MS analysis was carried out using GC model Clarus 680, Mass Spectrometer Clarus 600 (EI) Perkin Elmer, Gas Chromatography was equipped and coupled to a mass detector TurboMass 5.4.2 spectrometer with an Elite-5MS, (100% Dimethyl ply siloxane), 30.0m × 250µm df capillary column. The instrument was set to an initial temperature of 60°C and maintained at this temperature for 2min. At the end of this period, the oven temperature was raised upto 300°C, at the rate of an increase of 10°C/min and maintained for 6min. Injection port temperature was ensured as 250°C and Helium flow rate as 1ml/min. The ionization voltage was 70eV. The samples were injected in split mode as 10:1. Mass Spectral condition solvent delay 2min, transfer temperature 240°C, source temperature 240°C and scanning range was set at 50-600Da. The chemical constituents were identified by GC-MS[9].

Interpretation of mass spectrum of GC-MS was conducted using the database of National Institute Standard and Technology (NIST) having more than 62,000 patterns. The spectrum of the unknown component was compared with the spectrum of the known components stored in the NIST library. The retention time, compound name, molecular formula and molecular weight and area percentage of the test materials were ascertained.

RESULT AND DISCUSSION

GC-MS spectrum of ethanol extract of *Pteridium aquilinum* (L.) Kuhn showed 19 different major peaks which indicated the presence of 17 compounds. The prevailing compounds in ethanol extract were decane (12.1%), benzene, 1,2,3-trimethyl (6.18%), 1,3,7-Octatriene, 3,7-dimethyl (26.42%), Limonene (10.89%), Benzene, 1-methyl-3-propyl-(6.76%), Tetradecane (6.88%), 1,5-Hexadiene-3,4-diol, 3,4-dimethyl-(1.04%), Dodecane (2.12%), 2-[4-Chlorophenyl]-5-nitropyrimidine (1.86%), 1,2,3,4-Tetrahydro-.beta.-carboline, 5-methoxy-1-methyl (4.21%), 2-Chloro-6-fluorobenzyl alcohol, tert-butyl dimethyl silyl ether (6.98%), Z-(13,14-Epoxy), tetradec-11-en-1-ol acetate (4.17%), 1,2-Bis(trimethylsilyl), benzene (1.6%), 3-Quinolinecarboxylic acid, 6,8-difluoro-4-hydroxy-,ethyl ester (0.99%) N-Methyl-1-adamantaneacetamide (2.96%), 2-Ethylacridine (3.45%) and 3,3-Diisopropoxy-1,1,1,5,5,5-hexamethyltrisiloxane (0.41 %). The spectrum profile of GC-MS confirmed the presence of nineteen major components with retention time of 2.153min, 2.200min, 2.295min, 2.389min, 2.512min, 2.777min, 3.212min, 3.600min, 11.608min, 11.675min, 11.968min, 13.376min, 16.251min, 16.969min, 17.121min, 17.300min and 17.404min respectively (Figure-1 and Table-1).

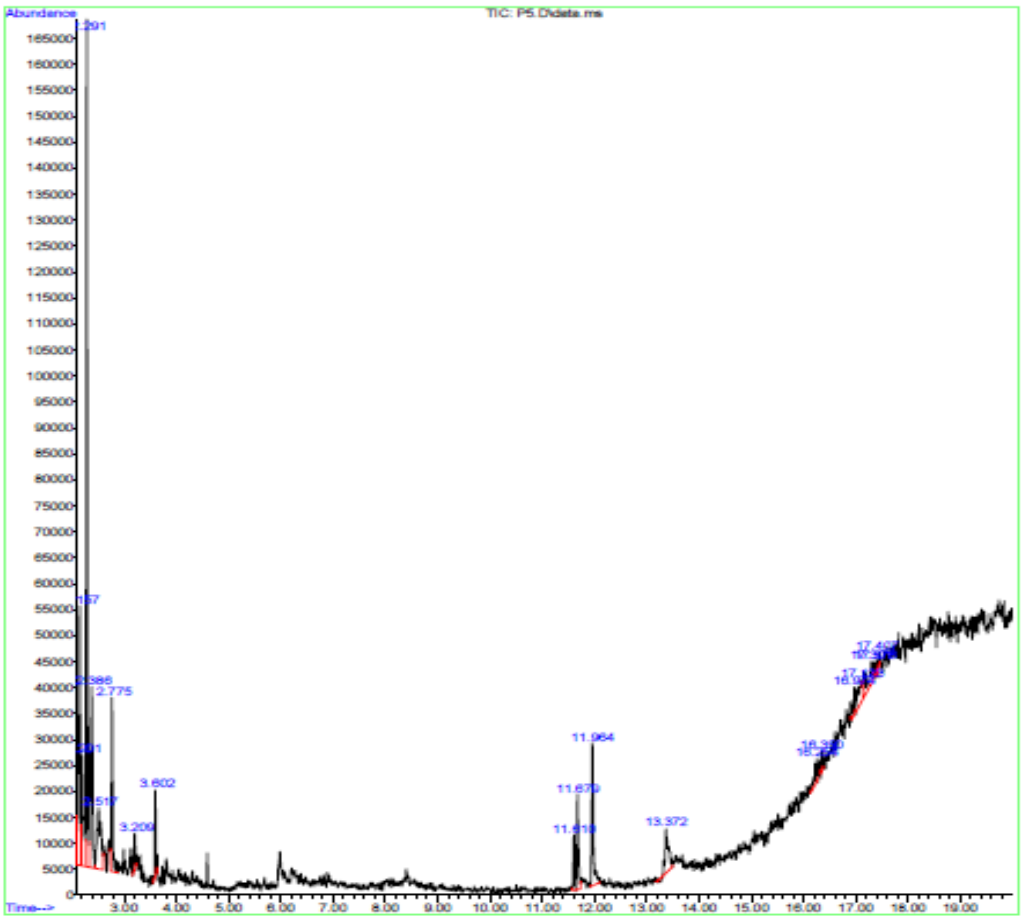

Figure-1: GC-MS profile of ethanol extract of *Pteridium aquilinum* (L.) Kuhn

Table-1: GC-MS profile of ethanol extract of *Pteridium aquilinum* (L.) Kuhn

SN	RT	Name of compound	MF	MW	PA
1.	2.153	Decane	$C_{10}H_{22}$	142.286	12.10
2.	2.200	Benzene, 1,2,3-trimethyl-	C_9H_{12}	120.195	6.18
3.	2.295	1,3,7-Octatriene, 3,7-dimethyl-	$C_{10}H_{16}$	136.238	26.42
4.	2.389	Limonene	$C_{10}H_{16}$	136.238	10.89
5.	2.512	Benzene, 1-methyl-3-propyl-	$C_{10}H_{14}$	134.222	6.76
6.	2.777	Tetradecane	$C_{14}H_{30}$	198.394	6.88
7.	3.212	1,5-Hexadiene-3,4-diol, 3,4-dimethyl-	$C_8H_{14}O_2$	142.198	1.04
8.	3.600	Dodecane	$C_{12}H_{26}$	170.34	2.12
9.	11.608	2-[4-Chlorophenyl]-5-nitropyrimidine	$C_{14}H_{12}ClN_3O_4$	321.717	1.86
10.	11.675	1,2,3,4-Tetrahydro-.beta.-carboline, 5-methoxy-1-methyl-	$C_{13}H_{16}N_2O$	216.284	4.21
11.	11.968	2-Chloro-6-fluorobenzyl alcohol, tert-butyldimethylsilyl ether	$C_{11}H_{21}FN_2O_2$	232.299	6.98
12.	13.376	Z-(13,14-Epoxy)tetradec-11-en-1-ol acetate	$C_{16}H_{28}O_3$	268.397	4.17
13.	16.251	1,2-Bis(trimethylsilyl) benzene	$C_{12}H_{22}Si_2$	222.478	1.60
14.	16.969	3-Quinolinecarboxylic acid, 6,8-difluoro-4-hydroxy-, ethyl ester	$C_{12}H_9F_2NO_3$	253.205	0.99
15.	17.121	N-Methyl-1-adamantaneacetamide	$C_{13}H_{21}NO$	207.317	2.96
16.	17.300	2-Ethylacridine	$C_{15}H_{13}N$	207.276	3.45
17.	17.404	3,3-Diisopropoxy-1,1,1,5,5,5-hexamethyltrisiloxane	$C_{12}H_{32}O_4Si_3$	324.639	0.41

SN: Serial Number; RT: Retention Time; MF: Molecular Formula; MW: Molecular Weight; PA: Peak Area.

CONCLUSION

GC-MS analysis of the ethanolic extract of *Pteridium aquilinum* (L.) Kuhn reveals the presence of bioactive components. Retention time, molecular formula, molecular weight and peak area were used for the confirmation of phytochemical compounds. Totally there were 17 bioactive principles were reported in the present study. Among them, the major constituents were decane (12.1%), 1,3,7-Octatriene, 3,7-dimethyl (26.42%) and Limonene (10.89%). The research work is in progress to ascertain the medicinal quality of the plant and brighten the phytochemical profile of it in the arena of medicinal value.

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