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Phytochemical Analysis of *Caesalpinia pulcherrima* (L.) Sw. Leaf Extract Using GC-MS Analysis

Jaikumar K, Sheik Noor Mohamed M, John Wyson W, Deventhiran M, Anand D, Saravanan P*

Post Graduate & Research Department of Botany, Ramakrishna Mission Vivekananda College, Mylapore, Chennai-600 004, Tamil Nadu, India

ABSTRACT

Most of the world's populations residing in developing countries depend on alternative medicine and use of plant ingredients. *Caesalpinia pulcherrima* (Fabaceae) is used in folk medicine for the treatment of various diseases including asthma, bronchitis, cholera, diarrhea, dysentery and malarial infection. The aim of the study to identified bioactive compounds presence in the chloroform leaf extract of *Caesalpinia pulcherrima* (L.) Sw. using Gas Chromatography and Mass Spectrometry (GC-MS) analysis. The leaf extraction was done by Soxhlet apparatus method. The GC-MS analysis has shown the presence of thirteen compounds in the chloroform leaf extract of *Caesalpinia pulcherrima* (L.) Sw. The identified bioactive compounds from this plant have been known to possess pharmacological activities.

Keywords: *Caesalpinia pulcherrima*, Non-polar, GC-MS analysis, Bioactive compounds.

INTRODUCTION

Phytoconstituents are the natural bioactive compounds found in plants. These phytoconstituents work with nutrients and fiber to form an integrated part of defense system against various diseases and stress conditions. [1] Nearly 80% of the world's population relies on traditional medicines for primary health care, most of which involve the use of plant extracts. [2] In India, almost 95% of the prescriptions were plant based in the traditional systems of Unani, Ayurveda, Homeopathy and Siddha. [3] Phytochemicals are responsible medicinal activity of plants. Phytochemicals are basically divided into two groups

that are primary and secondary metabolites based on the function in plant metabolism. Primary metabolites are comprise common carbohydrates, amino acids, proteins and chlorophylls while secondary metabolites consist of alkaloids, saponins, steroids, flavonoids, tannins etc. [4]

Caesalpinia pulcherrima (Fabaceae), popularly known as peacock flower or "Barbados" in English and as "Mayilkondrai" in Tamil, it is an ever green shrub growing three meter tall. It is a striking ornamental plant, widely grown in the tropical and subtropical zones. Phytochemical investigations on *Caesalpinia pulcherrima* have revealed the presence of various phytoactive constituents such as glycosides, rotenoids, isoflavones, flavanones, chalcones, flavanols, flavones and sterols. [5] Scientifically, aqueous extract of the fresh leaves and stem bark extracts of *Caesalpinia pulcherrima* have been reported to possess strong *in vitro* antifungal and antibacterial activities. [6-7] The *Caesalpinia*

*Corresponding author: Dr. P. Saravanan,

Post Graduate & Research Department of Botany, Ramakrishna Mission Vivekananda College, Mylapore, Chennai-600 004, Tamil Nadu, India;

E-mail: sarviveka@gmail.com

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pulcherrima flower contained numerous compounds, such as lupeol, lupeol acetate, myricetin, quercetin and rutin. [8] An ethyl acetate extract of the heartwood of *C. pulcherrima* exhibited potent DNA strand-scission activity [9] and antioxidant activity. [10] The *C. pulcherrima* show anti-inflammatory activity by inhibition of prostaglandin biosynthesis and nitric oxide production. [11] The *C. pulcherrima* leaves shows Gastric antiulcer activity. [12]

In recent years GC-MS studies have been increasingly applied for the analysis of medicinal plants as this technique has proved to be a valuable method for the analysis of non-polar components and volatile essential oil, fatty acids and lipids. [13] The present study is to identify the bioactive compounds from the chloroform leaf extract of *Caesalpinia pulcherrima* using GC-MS analysis.

MATERIALS AND METHODS

Collection of Plant Material

The leaves of *Caesalpinia pulcherrima* were collected from Ramakrishna Mission Vivekananda College Campus, Chennai, Tamilnadu, India. The plant material was identified and authenticated by Botanical Survey of India (BSI) with ref no.BSI/SRC/5/23/2016/Tech/256.

Preparation of Leaf Extract

The fresh leaves were collected and washed with running tap water, chopped into small pieces and then kept in shade dry for 30 days and then grounded using electric blender. 50 g of powdered leaves were extracted with 300ml of chloroform in soxhlet apparatus for 6 hours. The extract was then concentrated at reduced pressure using rotary evaporator and stored in vials at 4°C until further analysis. [14]

GC-MS Analysis

The composition of the chloroform extract was established by GC-MS analysis. The analysis was performed on a JEOL GCMATE II GC-MS system in EI/CI mode equipped with a split/split less injector (220°C), at a split ratio of 1/10, using a VF-1MS fused-

silica capillary column (30 m × 0.25 mm i.d.; film thickness: 0.25 mm). The oven temperature was programmed from 60°C (5 min) to 280°C at a rate of 4°C/min and held at the temperature for 10 min. Helium was used as a carrier gas at a flow rate of 0.8 ml/min. Mass spectra were taken at 70 eV; a scan interval of 0.5 s and fragments from 40 to 550 Da. The spectrums of the components were compared with the database of known spectrum components stored in the NIST library. [15]

RESULTS AND DISCUSSION

The composition of chloroform leaf extract of *C. pulcherrima* was determined by GC-MS analysis. Thirteen major bioactive compounds have been identified based on the spectral analysis (Fig. 1 and Table 1). Out of the 13 compounds identified the most prevailing compounds were observed namely 2(1H)-Naphthalenone, octahydro-4a-methyl-7-(1-methylethyl)-, (4aa,7a,8aa) with a peak area of 21.17 and Flavone with a peak area of 15.68.

Earlier reported that β -Sitosterol, Carotenoids, lutein and Zeaxanthin were identified as components of the active hexane extract of *C. pulcherrima* flower exhibited a growth suppressing effect against two human breast cancer cell lines MCF-7 and BT-20. [16] Whereas in the present study a similar compound α -Sitosterol was identified from chloroform leaf extract of *C. pulcherrima* with retention time of 21.15. In another study 19 oil constituents identified from the yellowish flower oil of *C. pulcherrima* some of the compounds namely α -phellandrene, β -caryophyllene, γ -Terpinene etc. [17] Among the compounds many compounds were reported to have antimicrobial and anticancer activity. The presence of various bioactive compounds in chloroform leaf extract of *C. pulcherrima* plant justifies that the whole plant is used by traditional practitioner to treat various ailments. However, the isolation of individual phytochemical constituents may definitely give fruitful tests.

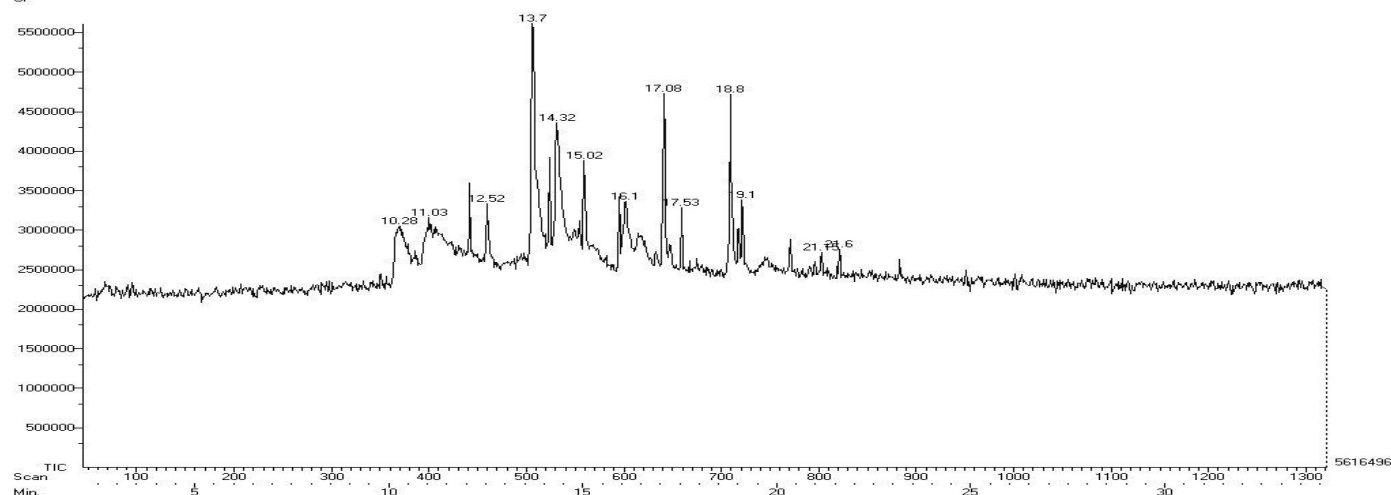


Fig. 1: GC-MS Chromatogram of Chloroform leaf extract of *Caesalpinia pulcherrima*

Table 1: GC-MS Profile of Chloroform leaf extract of *Caesalpinia pulcherrima*

S. No	RT	Name of the Compound	Molecular Weight	Molecular Formulae	Peak Area %	Structure
1	10.28	2-Propenal,3-(2-methoxyphenyl)	162.18	C ₁₀ H ₁₀ O ₂	11.52	
2	11.03	Eugenol	164.20	C ₁₀ H ₁₂ O ₂	4.69	
3	12.52	Phenol,2,4-bis(1,1-dimethylethyl)	206.32	C ₁₄ H ₂₂ O	5.29	
4	13.7	2(1H)-Naphthalenone, octahydro-4a-methyl-7-(1-methylentyl)-,(4aa,7a,8aa)		C ₁₄ H ₂₄ O	21.17	
5	14.32	Flavone	222.23	C ₁₅ H ₁₀ O ₂	15.68	
6	15.02	Longipinocarveol,trans-	220.35	C ₁₅ H ₂₄ O	4.45	
7	16.1	Quinone-4-oxime,2,6-di-t-butyl	235.32	C ₁₄ H ₂₁ NO ₂	5.04	
8	17.08	4',5,7,-Trihydroxy isoflavone	270.24	C ₁₅ H ₁₀ O ₅	10.90	
9	17.53	1-Benzazirene-1-carboxylic acid,2,2,5a-trimethyl-1a-(3-oxo-1-butenyl)perhydro-,methyl ester	265.34	C ₁₅ H ₂₃ NO ₃	1.93	
10	18.8	10-Octadecenoic acid, methyl ester	296.48	C ₁₉ H ₃₆ O ₂	9.94	
11	19.1	4H-1-Benzopyran-4-one, 8-[(dimethylamino)methyl]-7-methoxy - methyl-2-phenyl-	323.38	C ₂₀ H ₂₁ NO ₃	5.22	
12	21.15	α-Sitosterol	414.70	C ₂₉ H ₅₀ O	2.33	
13	21.6	Propanoic acid, 2-(3-acetoxy-4,4,14-trimethylandro-8-en-17-yl)-	430.61	C ₂₇ H ₄₂ O ₄	1.78	

RT-Retention time

From the results, it is concluded that *Caesalpinia pulcherrima* contains various bioactive compounds. Therefore, it is recommended as a plant of phytochemical importance.

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