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GAS CHROMATOGRAPHY-MASS SPECTROSCOPY ANALYSIS OF ETHANOLIC LEAVES EXTRACT OF *MARANTA ARUNDINACEA* L.

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Abstract: Medicinal plants are considered to be a good resource to procure diverse drugs. We are so lucky to have our nature with a diverse variety of plants that posses' different properties. Plants possess many biological activities due to the presence of bioactive components in it. *Maranta arundinacea L.* commonly known as arrowroot belongs to the family Marantaceae. It is native to South America, West Indies, Mexico and, Central America and is mostly cultivated in India, China, Sri Lanka and, Philippines. This is a starchy rich tuberous plant. This study to analyses the phytocomponents in an ethanolic extract of its leaves by the gas chromatography-mass spectrometry (GC-MS) method. The GC-MS analysis of an ethanolic extract of its leaves showed the presence of 9 active phytocomponents. These phytocomponents have possessed diverse activities, which provides a medicinal and therapeutic usage to its leaves instead of wasting or making them as livestock.

Index Terms **– Maranta arundinacea, GC-MS, Phytocomponents, Ethanolic extract, leaves**

I. INTRODUCTION

Now-a-days herbal products have procured great demand globally. Plants are considered as rich source of potent and powerful medicines. Plant posses' diverse properties due to the presence different phytocomponents. These components are the plant's secondary metabolite and they possess biological properties like dietary fibre, antioxidants, anticancer, detoxifying agents, immunity-potentiating agents and neuropharmacological agents. Phytochemicals accumulate in plant parts like roots, stems, leaves, flowers, fruits or seeds[1]. Our earth has richest source for the herbs and medicinal plants in different areas. One of the plants among these is *Maranta arundinacea* L., commonly knowns as west Indian arrowroot. It belongs to the family Marantacea. This is a starch rich tuberous plant and is used as medicinal plant from the traditional period onwards. This is a monocot plant with vegetative propagation. It has a cluster of long, slender stems and their stems bear alternate, long lanceolate leaves. This plant has rhizomes which are fibrous, fusiform, fleshy and are rich in starch. This plant bears small, cream, or nearly white-colored compound flowers. It has been distributed throughout tropical countries like India, Sri Lanka, Indonesia, the Philippines, Australia, and West Indies.

This plants' starch rich rhizomes are used for the treatment of indigestion, diarrhoea and urinary infections. It also cures acidity, indigestion, abdominal pain and irritation on gastrointestinal tract. This plant has antiseptic, anti-inflammatory, antidiarrheal and antioxidant activities. The rhizomes are also used to draws out poison from injured areas [2,3,4]. Because of these important biological activities, a study should be carried out to analyse the phytochemical components in the ethanolic extracts of its leaves by using gas chromatography-mass spectroscopy (GC-MS).

Gas chromatography (GC-MS) is employed for the direct analysis of components existing in traditional medicines and medicinal plants. Now-a-days GC-MS studies have great demand for the analysis of phytocomponents, since it is a good method for the analysis of non-polar components, fatty acids, lipids, sterols, alkaloids and so on. Chromatographic technique combined with mass spectrometry (GC-MS) provides the benefit of the two, chromatography as the separation method and mass spectrometry as the identification method. GCMS analysis is a mostly used confirmation test for an effective chemical analysis. This analysis gives a representative spectral output of all the components that are separated out from the sample. GC-MS was initiated by the sample injection in to the injected port of the Gas chromatography (GC) device. The sample get vaporized and then the various components get separates and analyses it at GC instrument. Each component will create a specific spectral peak that would be recorded electronically. Using the retention time compounds were identified out. The peak has measured out from the base of the peak to its tip. GC-MS analysis is an effective tool for determine the plants' non-nutrient chemicals called phytochemicals which provides prevention or protection from various diseases [5,6]. In this study the phytochemicals present in the ethanolic extract of leaves of *Maranta arundinacea* (Fig. 1) is analysed out using GC-MS.

Fig.1 *Maranta arundinacea*

II. MATERIALS AND METHODS

2.1 Plant material collection

The fresh leaves of *Maranta arundinacea* were collected from local areas of Koppam, Vithura, Thiruvananthapuram, Kerala, India. The specimens collected were identified and authenticated by Dr. Ranjusha A.P, Department of botany, NSS College, Ottapalam, Palakkad, Kerala, India. The specimen was deposited in the herbarium (accession.no:18368) of the Kerala Forest Research Institute, Peechi, Thrissur, India.

2.2 Plant extract

The collected plant leaves of *Maranta arundinacea* L. was shade dried, powdered (20 g) and extracted with ethanol for 24 hours using Soxhlet apparatus. The extract was collected, filtered out using Whatmann filter paper No:1 and is concentrated and stored out. This ethanolic extract was subjected to the GC-MS analysis.

2.3 GC-MS Analysis

The GC-MS analysis of ethanolic extract of plant *Maranta arundinacea* was carried out using Shimadzu GC-MS of model number QP2010S which is equipped with capillary column ELITE-5MS (5% diphenyl/95% dimethyl poly siloxane) of 30-meter length and 0.25 µm thickness and 0.25mm internal diameter. Helium was the carrier gas used in it. The sample was injected using split mode of ratio 20.0 and the injector was operated at temperature 260ºC and the oven was operated at the temperature of 70ºC (Details in Table 2). Details of GC programme was given in table 1 and 3. The components were identified by comparing their relative retention time and analysis on mass spectrum of GC-MS was carried out using the database of National Institute Standard and Technology (NIST 11), WILEY 8. Table 4 shows details of mass spectroscopy. [7,8]

Table 1: GC Programme (GC-2010)

GC-Parameters	Programme
Column Oven Temp.	70.0 ºC
Injection Temp.	260.00º C
Injection Mode	Split
Flow Control Mode	Linear Velocity
Pressure	61.5 KPa
Total Flow	24.0 m L /min
Column Flow	1.00 m L/ min
Linear Velocity	36.7 cm /sec
Purge Flow	3.0 m L/min
Split Ratio	20.0
Splitter Hold	OFF

Table 2: Oven temperature program

Rate	Temperature (ºC)	Hold Time (min)
-	70.0	2.00
10.00	200.0	5.00
5.00	280.0	15.00

Table 3: GC Program

Ion source temperature	200.00ºC
Interface temperature	280.00ºC
Solvent cut time	6.50 min
Detector gain mode	Relative
Detector gain	0.98 kV +0.20 KV
Threshold	1000

Table 4: MS Table

Start time	6.70 min
End time	51.00 min
ACQ Mode	Scan
Event time	0.50 sec
Scan speed	1000
Start m/z	50.00
End m/z	500.00

III. RESULTS AND DISCUSSION

GC-MS analysis of the ethanolic extract of *Maranta arundinacea* [figure 2] showed nine peaks, which indicates the presence of nine phytoconstituents. The comparison of the mass spectra with NIST library, the nine phytocompounds were characterized and identified given in table 5. The diverse phytocompounds with their biological activities are also given in table 5.the mass spectra of the compounds that are identified in ethanolic leaf extract of *Maranta arundinacea* showed in Figure 3. From the identified compounds, the most triumphing one is phytol (40.51%). The Phytol is the vital acyclic diterpene alcohol and a precursor for vitamins E and K1. By inducing disruption to cell membranes, phytol was found to exhibit antibacterial properties against Staphylococcus aureus. It also possess antioxidant, anticancer activities. Gamma-sitosterol shows 13.26 % peak area. It is an epimer of β-sitosterol, and it can be used for Diabetes mellitus treatment by increasing insulin secretion and inhibition of glucogenesis. γ -sitosterol can used for producing a potent antidiabetic drug [12]. The presence of ethyl palmitate, palmitic acid, ethyl ester was also found. This may provide the effects like anti-inflammatory, Anti-oxidant, Hypocholesterolaemia, Nematicide, Anti-androgenic, Haemolytic, Pesticide, Lubricant, 5-Alpha reductase inhibitor, antipsychotic, Antifungal, Anti-tumour, Antibacterial [15]. The compound, stigmasterol with peak area 7.05 % was found and may reveal the properties like anti-osteoarthritic, anti-hypercholesterolemia, cytotoxicity, antitumor, hypoglycaemic, antimutagenic, antioxidant, anti-inflammatory and CNS effects [13]. Neophytadiene is a compound that exhibits analgesic, antipyretic, anti-inflammatory, antimicrobial, and antioxidant properties. Hexadecanoic acid compound may reveals strong antimicrobial and anti-inflammatory activity [9,10,11].

Thus GC-MS analysis is a good step to find out the phytoconstituents in a plant extract. The presence of diverse bioactive compounds in the leaves of *Maranta arundinacea* shows it may subject some biological activity that will definitely provide profitable results. It is possible to deduce from the findings that ethanolic extract of leaf of *Maranta arundinacea* has a number of bioactive substances, thus it may be promoted as phytopharmaceutical plant.

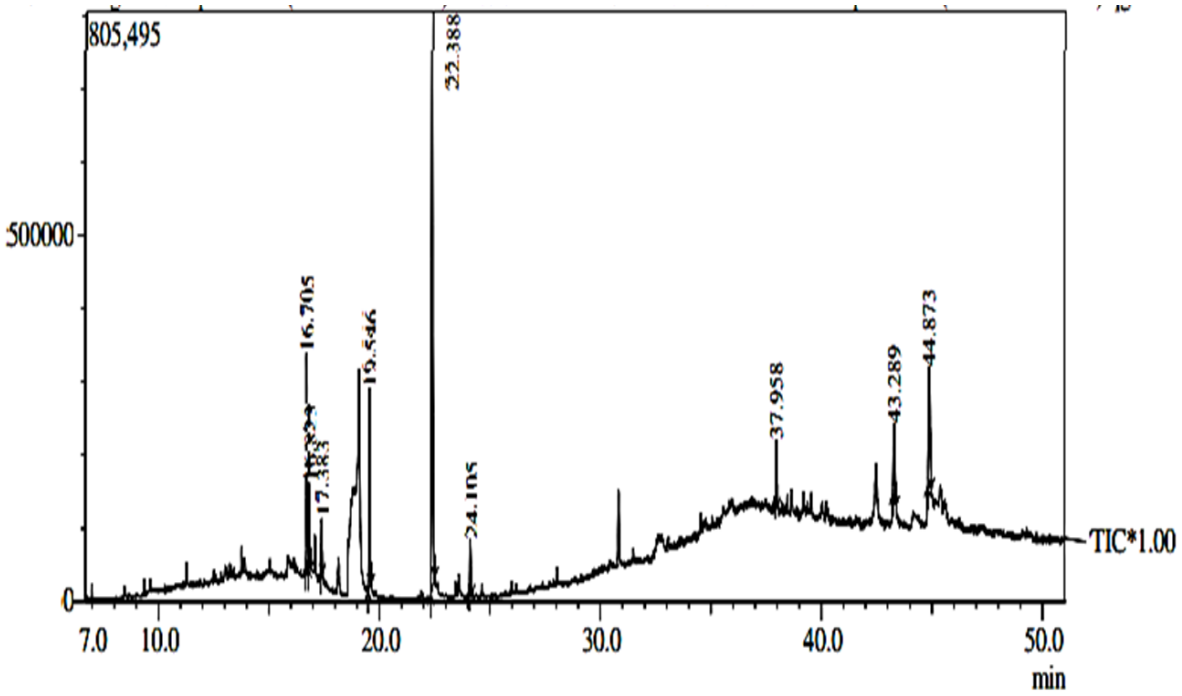
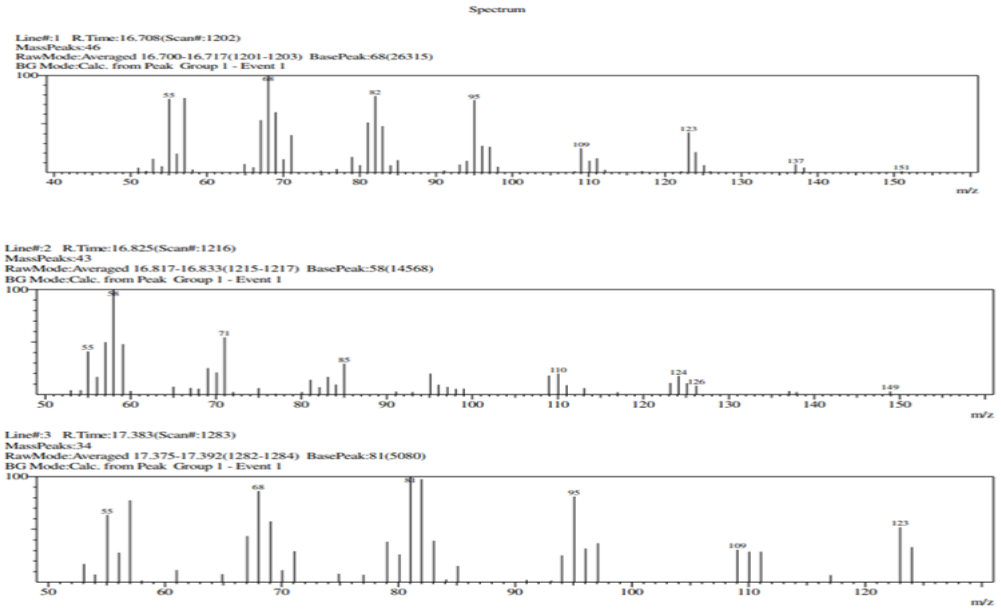


Fig .2 GC-MS analysis of the ethanolic extract of *Maranta arundinacea* leaves



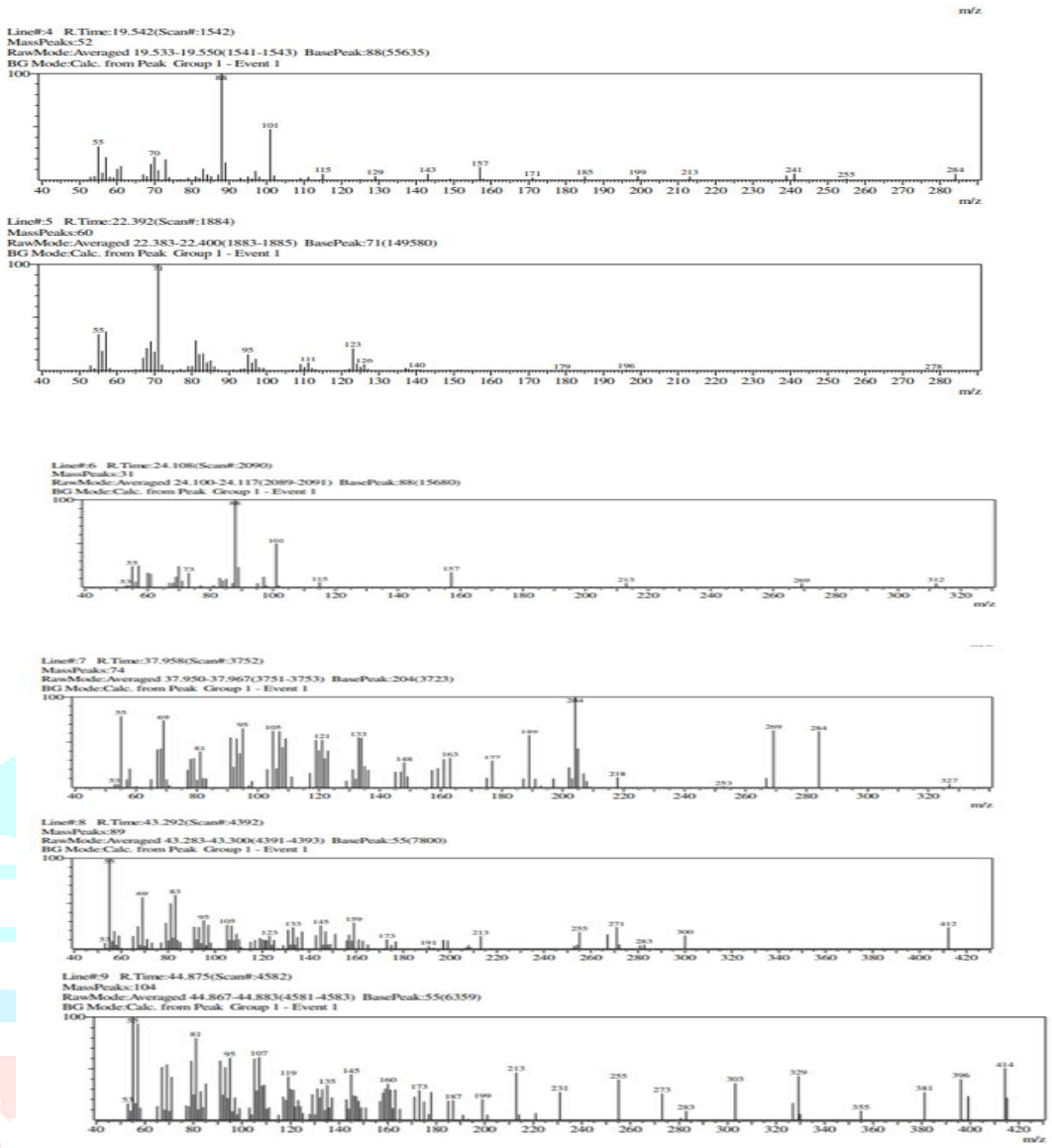


Fig 3 Mass spectra of the compounds that are identified in ethanolic leaf extract of *Maranta arundinacea*

Table 5: Diverse phytocompounds identified by GC-MS with their activity

RT	Name of the compound	Peak area%	Base m/z	Activity
16.705	Neophytadiene	12.11	68.05	Analgesic, antipyretic, anti-inflammatory, antimicrobial, and antioxidant
16.823	Hexahydrofarnesl acetone	5.20	58.00	Antimicrobial and anti-inflammatory activity.
17.383	3,7,11,15-tetra methyl-2-hexadecen-1-ol	2.32	81.05	Strong antimicrobial and anti-inflammatory activity
19.546	Ethyl palmitate	12.85	87.95	Antioxidant, anti-inflammatory, anticancer
22.388	Phytol	40.51	71.00	Antimicrobial, antioxidant, and anticancer activities
24.105	Palmitic acid, ethyl ester	3.14	88.00	Anti-oxidant, Hypocholesterolaemia, Nematicide, Anti-androgenic, Haemolytic, Pesticide, Lubricant, 5-Alpha reductase inhibitor, antipsychotic.
37.958	Farnesyl bromide	3.56	204.10	Antiplasmodic activity
43.289	Stigmasterol	7.05	55.00	Antioxidant, antimicrobial, anticancer, anti-arthritic, anti-asthma, anti-inflammatory, anti-osteoarthritic, anti-hypercholesterolemia, cytotoxicity, antitumor, hypoglycaemic, antimutagenic, and CNS effects
44.873	Gamma-Sitosterol	13.26	55.10	Antimicrobial, Anticancer, Hepatoprotective, Anti-arthritic, anti-asthma

IV. CONCLUSION

In this study, the gas chromatography- mass spectroscopy (GC-MS) analysis of the ethanolic extract of the leaves of *Maranta arundinacea* was carried out and it revealed the presence of nine compounds with different peak area and retention time. The compounds identified are Neophytadiene, Hexahydrofarnesl acetone, 3,7,11,15-tetra methyl-2-hexadecen-1-ol, Ethyl palmitate, Phytol, Palmitic acid, ethyl ester, Farnesyl bromide, Stigmasterol, Gamma-sitosterol. These phytocompounds are able to provide biological activities like antioxidant, antimicrobial, anti-inflammatory, antidiabetic, anticancer and so on. Therefore, it seems that the leaves of *Maranta arundinacea* also possess some activities like its rhizomes. Further studies will be carried on its leaf for development of pharmaceutical or nutritional product.

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