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Phytochemical Screening and GC-MS Analysis of Ethanolic Extract of Rhizomes of *Maranta arundinacea* L.

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ABSTRACT

Maranta arundinacea .L commonly known as arrowroot is a starch rich tuberous plant. The rhizomatous tubers medicinal value is yet unexplored, hence this study forms a basis for the active components present in it and further isolation of the compound. The aim of this study is to screen the phytochemicals present in the rhizomes of *Maranta arundinacea* .L and further analysis of the components present in it by GC-MS analysis. The rhizomes were sequentially extracted based on the polarity viz., petroleum ether, chloroform, ethyl acetate and ethanol. The ethanolic extract showed the presence of all phytoconstituents studied.The GC-MS analysis of the ethanolic extract revealed the presence of 49 compounds. This study forms a basis for the biological characterization and importance of the compounds identified.

Keywords: *Maranta arundinacea* .L, Phytochemical screening, GC-MS analysis.

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INTRODUCTION

Plant products have been part of phytomedicines since time immemorial. These can be derived from any part of the plant like bark, leaves, flowers, roots, fruits, seeds etc.,[1] i.e. any part of the plant may contain active components. Herbal medicines have become more popular in the treatment of many diseases due to popular belief that green medicine is safe, easily available and with less side effects. Many plants are cheaper and more accessible to most people especially in the developing countries than orthodox medicine, and there is lower incidence of adverse effects after use. These reasons might account for their worldwide attention and use [2].The medicinal properties of some plants have been documented by some researchers [3- 5]. Medicinal plants constitute the main source of new pharmaceuticals and healthcare products [6].Extraction and characterization of several active phytocompounds from these green factories have given birth to some high activity profile drugs [7]. Indeed, the market and public demand has been so great that there is a great risk that many medicinal plants today, face either extinction or loss of genetic diversity [8]. Knowledge of the chemical constituents of plants is desirable because such information will be value for the synthesis of complex chemical substances .Such phytochemical screening of various plants is reported by many researchers[9- 11].A grow ing body of evidence indicates that secondary plant metabolites play critical roles in human health and may be nutritionally important [12].It is believed that crude extract from medicinal plants are more biologically active than isolated compounds due to their synergistic effects[13].Phytochemical screening of plants has revealed the presence of numerous chemicals including alkaloids, flavonoids, tannins, steroids, glycosides and saponins. Secondary metabolites from plant serve as defense mechanisms against predation by many microorganisms, insects and herbivores [14].

Arrowroot (*Maranta arundinacea* .L) is a tuberous rhizomatous plant, a native of tropical America also widely grown in countries like India, Sri Lanka, Indonesia, Australia and Philippines. The tuberous rhizomes are rich in starch, and used in confectionery for the preparation of biscuits and also in the preparation of weaned foods. The arrowroot starch was found to be effective in treatment of diarrhea. The arrowroot tuber contains plenty of starch and other compounds. The starch from arrowroot flour has a nutrition composition of 11.9% water, 0.58% ash, 25.9% amylose, 0.14% protein, 0.84% fat, 8.7% insoluble dietary fiber, and 5.0% soluble dietary fiber [15]. Recent study suggested that the arrowroot flour is a potential source of prebiotics [16].Earlier reports on the biological activities of *M.arundinacea* .L in the literature are rare. This forms the basis to reveal the biologically significant compounds present in *M.arundinacea*.L, So that this plant can be used as a therapeutic source for various human ailments. Hence it is obligatory to screen the secondary metabolites, the key factor in therapeutics. GC-MS is one of the best techniques to identify the bioactive constituents of long chain branched chain hydrocarbons, alcohols, acids, ester etc. To explore the medicinal importance the rhizomes of *M.arundinacea* .L were screened primarily for the phytochemicals present in it and was analyzed using GC-MS.

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MATERIALS AND METHODS

The tuberous rhizomes with leaves and flowers of *M. arundinacea* L. were collected in December from Malampuzha, Palakkad District, Kerala and identified by Dr.G.V.S.Murthy. A voucher specimen was deposited in the herbarium of the Botanical Survey of India, Coimbatore; Herbarium code number No.BSI/SRC/5/23/10-11/Tech. Plant materials were washed with distilled water and dried at room temperature. The dried rhizomes were manually ground to a fine powder. The coarsely powdered tuberous rhizomes of *M.arundinacea* L. were extracted sequentially with petroleum ether, ethyl acetate and ethanol by cold percolation method. All the extracts were subjected for phytochemical screening as per the methods given by Harborne *et al* [17]. The ethanolic extract was used for GC-MS analysis.

GC-MS Analysis

GC-MS analysis of the extract was performed using a Thermo GC –Trace ultra Ver: 5.0 system and Gas chromatograph interfaced to a Mass spectrometer (GC-MS)(Perkin-Elmer GC Clarus 500 system) equipped with TR 5 – MS capillary standard non-polar column (30mmX0.25mm 1D X 1 µMdf). For GC-MS detection, an electron ionization system with ionizing energy of 70 eV was used. Helium gas (99.999%) was used as the carrier gas at constant flow rate 1ml/min and an injection volume of 2µl was employed (split ratio of 10:1); Injector temperature 80°C; Ion-source temperature 250°C. The oven temperature was programmed from 110°C (isothermal for 2 min.), with an increase of 10°C/min, to 200°C, then 5°C/min to 250°C, ending with a 9min isothermal at 280°C. Mass spectra were taken at 70 eV; a scan interval of 0.5seconds and fragments from 45 to 450 Da. Total GC running time was 36.91 minutes. The components were identified based on comparison of their relative retention time and mass spectra with those of Wiley 7N Library data. The results were also confirmed by the comparison of the compounds elution and order with their relative retention indices on non-polar phases reported in the literature. The Name, Molecular weight and structure of the components of the test material was ascertained.

RESULTS AND DISCUSSION

Preliminary phytochemical screening of the rhizomes of *M.arundinacea*.L are shown in the Table 1

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Table 1: Phytochemical screening of the rhizomes of *Maranta arundinacea.L*

Phytochemicals	Petroleumether extract	Chloroform extract	Ethylacetate extract	Ethanolic Extract
Flavonoids	-	-	+	+
Alkaloids	-	-	-	+
Tannins	-	-	+	+
Glycosides	+	+	+	+
Steroids	+	+	+	+
Phenols	-	-	+	+
Cardiac glycosides	+	+	+	+
Saponins	+	+	+	+
Carbohydrates	+	+	+	+
Proteins	-	-	-	+

'+' Presence '-' Absent

The components present in the ethanol extract of rhizomes of *M. arundinacea.* L was identified by GC-MS analysis (Figure 1). The active compounds with their retention time (RT), Molecular formula and Molecular weight (MW) in the ethanol extract of rhizomes of *M. arundinacea.* L are presented in Table 2. Forty nine compounds were identified in ethanol extract of rhizomes of *M. arundinacea.* L.

Figure 1: GC-MS chromatogram of the ethanolic extract of *Maranta arundinacea*. L Rhizomes

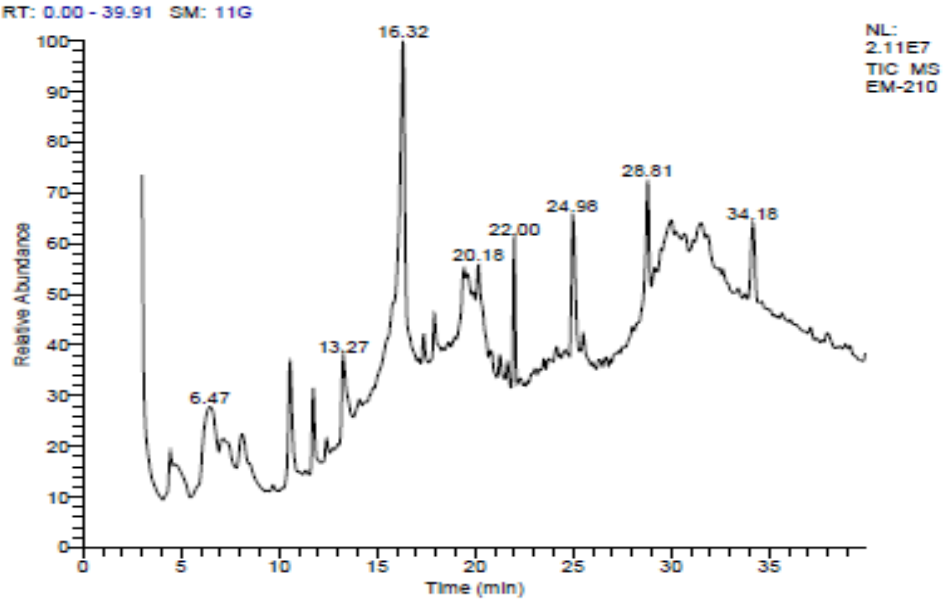

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Table 2: **Compounds present in the ethanolic extract of *Maranta arundinacea* .L rhizomes**

S.NO	RT	Name	Molecular Formula	Molecular Weight
1	4.45	Cyclohexanone	$C_6H_{10}O$	98
2	4.45	2-Hydroxy- cyclopenta-2,4-dienone	$C_5H_6O_2$	98
3	6.41	2,3-Dimethoxy-succinicacid dimethyl ester	$C_8H_{14}O_6$	206
4	6.41	5-Diethylsilanyloxy-4-ethyl-2 phenyl-3a,4,7,7a-tetrahydro-isoindole-1,3-dione	$C_{22}H_{31}NO3Si$	385
5	6.41	Triethyl-(3-methyl sulfanyl-1-vinyl-pent-1-enyloxy)-silane	$C_{14}H_{28}OSSi$	272
6	7.18	(2-Methyl-thiiranyl)-methanol	C_4H_8OS	104
7	7.18	2-tert-Butoxy-tetrahydro-furan	$C_8H_{16}O_2$	144
8	7.18	Cis-2-(7-octynyl)cyclohexanol	$C_{17}H_{32}OS$	280
9	8.10	4-tert-Butyl-[1,3,2]dioxathiolane 2-oxide	$C_6H_{12}O_3S$	164
10	8.10	(2-Acetoxy-1-methyl-vinyl)-methylidyne-ammonium	$C_6H_7NO_2$	125
11	8.10	Tetradecane	$C_{14}H_{30}$	198
12	10.54	Cyclohepta-2,4,6-trienecarboxylic acid ethyl ester	$C_{10}H_{12}O_2$	164
13	10.54	Benzyl-butyl-amine	$C_{11}H_{17}N$	173
14	11.74	1-Ethoxymethyl-4-methyl-benzene	$C_{10}H_{14}O$	150
15	11.74	1-(4-Methoxy-cyclohexyl)-hex-5-en-1-one	$C_{13}H_{16}O_2$	204
16	11.74	9-(4-Methoxy-phenyl)-9-oxo-nonanoic acid methyl ester	$C_{17}H_{24}O_4$	292
17	12.42	2,6-Dimethoxy phenol	$C_8H_{10}O_3$	154
18	12.42	2- Methoxy-3-methyl-benzene-1,4-diol	$C_8H_{10}O_3$	154.766
19	12.42	2,4-Dimethoxy phenol	$C_8H_{10}O_3$	154
20	13.27	2-tert-Butyl-1,2-dimethyl-cyclopropane,carboxylic acid methyl ester	$C_{11}H_{20}O_2$	184
21	13.27	1,1,2,2-tetramethyl-3-oxo-octahydro-4-oxa-cyclobuta(α)naphthalene-2a-carbonitrile	$C_{16}H_{17}NO_2$	255
22	13.27	C-[2,2-Dimethyl-3-(2-methyl-propenyl)-1-phenylsulfanyl-cyclopropyl]-methylamine	$C_{16}H_{23}NS$	261
23	16.10	2-Phenoxysulfonyl-acetimidic acid methyl ester	$C_9H_{11}NO_4S$	229
24	16.32	2-Phenoxysulfonyl-acetimidic acid methyl ester, hydrochloride	$C_9H_{12}ClNO_4S$	265
25	16.32	3, 6, 10-Trimethyl-8,11-dihydro-7H-cyclodeca[b]furan-4-one.	$C_{15}H_{18}O_2$	230
26	16.32	1-Benzyl-4-tert-butyl-4,5-dihydro-1H[1,2,3,4,5]-thiatetrazoborole	$C_{12}H_{19}BN_4$	230
27	16.32	4-Ethoxymethylene-7,7-dimethyl-bicyclo[3.2.0] hept-2-en-6-one	$C_{12}H_{16}O_2$	192
28	17.36	2-(2-Nitroallyl)-cyclohexanone	$C_9H_{13}NO_3$	183
29	17.36	1,4,7,10,10-Pentamethyl-2,4,6,8,9-pentaaza-tricyclo[5.2.1.$0^{2,6}$]dec-8-ene-3,5-dione	$C_{10}H_{15}N_5O_2$	237
30	17.36	2,3,3,4,7-Pentamethyl-1,5,7-triaza-tricyclo[3.3.0.$0^{2,4}$]octane-6,8-dione	$C_{10}H_{15}N_3O_2$	209
31	17.91	6-Chloro-3,4,4a,5,6,8a-hexahydro-2H-chromene	$C_9H_{13}ClO$	172

32	17.91	5-(1-chloro-1-methyl-ethyl)-3,5-dimethyl-cyclopent-2-enone	$C_{10}H_{15}ClO$	186
33	17.91	7a-(2-Methoxy-ethyl)-1-methyl-1,2,3,6,7,7a-hexahydro-inden-5-one	$C_{13}H_{20}O_2$	208
34	17.91	3-3-(Methoxy-phenyl)-2-methyl-oxetan-3-ol	$C_{11}H_{14}O_3$	194
35	19.41	2-Benzyloxy-7-(tetrahydro-pyran-2-yloxy)-heptan-1-ol	$C_{19}H_{28}O_4$	320
36	19.41	(1-Acetyl-5-formyl-6-methyl-cyclohexa-2,4-dienyl)-acetic acid ethyl ester	$C_{14}H_{18}O_4$	250
37	19.41	3-Phenyl-1-(toluene-4-sulfonyl)-pyrrolidine-2,5-dicarboxylic acid 2- benzyl ester 5-tert-butyl ester	$C_{30}H_{33}NO_7S$	551
38	20.18	Cyclopropyl-oxo-acetic acid methyl ester	$C_6H_8O_3$	128
39	20.84	2-Allyl-5a-hydroxy-octahydro-5-oxa-2-aza-cyclopenta[c]inden-1-one	$C_{13}H_{19}NO_3$	237
40	21.26	Cyclohexylmethyl-diethyl-methoxy-silane	$C_{12}H_{20}OS$	208
41	21.26	2,2-Dimethoxy-4a,5,6,7,8,8a-hexahydro-2H-benzo[e][1,2]oxasilane	$C_{10}H_{20}O_3Si$	208
42	21.26	2,2-Dimethoxy-2H-benzo[e][1,2]oxasilane	$C_{10}H_{12}O_3Si$	208
43	21.26	4-(3,4-Dimethoxy-phenyl)-butan-1-ol	$C_{12}H_{16}O_3$	208
44	24.16	1,1-Diethoxy-2-methyl-propane	$C_8H_{18}O_2$	146
45	24.16	2,4'-Dimethyl-[2,4']bi[[1,3]dioxanyl]	$C_{10}H_{18}O_4$	202
46	24.16	2-Methyl-3,3-bis-(2-trimethylsilane-ethoxy)-propionic acid methyl ester	$C_{15}H_{34}O_4Si_2$	334
47	29.94	2-Methoxyimino-4-methyl-pentanoic acid benzyl ester	$C_{14}H_{19}NO_3$	249
48	29.94	2-(Benzyl-{2-[(dimethyl carbamoyl-phenyl-methylene)-hydrazino]-ethyl}-hydrazono)-N,N-dimethyl-2-phenyl-acetamide	$C_{36}H_{40}N_6O_2$	588
49	29.94	3-Methylene-1-oxa-spiro[3,6]decane	$C_{10}H_{16}O$	152

To explore the importance of any medicinal plant the initial step is to screen for its phytochemicals, as it gives a broad idea regarding the nature of compounds present in it. In the present study, the rhizomes of *Maranta arundinacea*. L was preliminarily screened for the phytochemicals,among the four extracts, ethanolic extract was found to be rich in all the

phytoconstituents followed by ethylacetate extract. The chloroform and petroleum ether extract were uniformly positive for the phytochemicals studied. The starch is found to be the major component in this rhizomatous tuber, hence all the four extracts were found positive for carbohydrates. This starch may be assumed to play a significant role in some physiochemical and biological activities. Previous studies on the phytochemical screening of tuber *Dioscorea bulbifera* also revealed the presence of alkaloids, steroids, fats and fixed oil, flavonoids, tannins, proteins and carbohydrates [18].This phytochemical screening aids as an initial step for future determination of its activity like antioxidant, anticancer, antiinflammatory, antimutagenic etc. In a previous report on phytochemical screening of methanolic extract of roots and stem of *Pseudarthria viscida* showing presence of alkaloids, flavonoids, saponin, tannins and phenol was subjected for evaluation of antioxidant activity [19].Similar work was carried out based on phytochemical screening and further antioxidant determination for *Aerva lanata* (L) by Ragavendran *et al* [20] .Earlier report on the phytochemical analysis of ethanolic extract of *Tylophora pauciflora* also revealed the presence of alkaloids, flavonoids, tannins, phenols, saponins, steroids, aminoacids and proteins, oils and fats, terpenoids and carbohydrates[21].The phytoconstituent rich ethanolic extract of *Maranta arundinacea*. L was subjected to Gas Chromatography-Mass spectrometry (GC-MS) analysis. The result revealed the presence of 49 compounds. Earlier studies on chemical investigation of tubers of *Stephania wightii* by GC-MS indicated the presence of 13 compounds [22].Similar work was reported for chemical composition analysis of essential oil of *Curcuma amada* by Vishnupriya *et al* [23]. This type of GC-MS analysis is the first step towards understanding the nature of active principles in this plant. Thus the plant studied can be used as a potential source of new useful drugs. The phytochemical characterization of the extracts, the isolation of responsible bioactive compounds and their biological activity are necessary for future studies.

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