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Research Article

Phytochemical Screening and GC-MS Studies on the Ethanolic Extract of *Turnera Ulmifolia* L.

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Abstract

Turnera ulmifolia Linn. belonging to family Turneraceae was investigated to evaluate the presence of secondary metabolite and bioactive compounds through preliminary phytochemical studies and GCMS analysis. The results reveals the presence of alkaloids, flavonoids, glycosides, phenol, steroids, tannins, and reducing sugar in leaf, flavonoids, glycosides, phenol, saponins, triterpenoids in stem and flavonoids glycosides steroids, tannins and reducing sugar in ethanolic root extracts. The GCMS analysis reports shows the presence of 17 compounds in the leaf ethanolic extract of *T. ulmifolia* by comparing their retention time and by interpretation of their mass spectra. Among the identified compounds the important bioactive compounds are Toosendanin (42.76%), 4-Dimethylamino [1, 1':3', 1''] terphenyl-4'-yl) phenylmethanone (18.45%), Methyl 13C hexadecatrienoate (5.48%), Pyranthrene (3.80%) Benzoic acid (2.81%), Neophytadiene (2.40%) and Phytolfluene (1.06%). The presence of various bioactive compounds confirms the application of *T. ulmifolia* for various ailments by traditional practitioners. However, isolation of individual phytochemical constituents may proceed to find a novel drug.

1. INTRODUCTION

Medicinal plants are believed to be an important source of new chemical substances with potential therapeutic effects¹ plant derived drugs have a market of about 20 billion annually in the United State alone. It is also estimated that only 5-15 % of potential useful plants have so far been systematically explored for useful chemical². The phytochemical research based on ethanopharmacological information is considered an effective³. The chemical substances used by plants for approach in the discovery of new agents from higher plants defense system and serve as the bioactive principle for various drugs in modern chemotherapy⁴. The GCMS is composed of two major building blocks; the gas chromatograph and the Mass spectrometer. The gas chromatograph utilizes a capillary column which depends on the columns dimension as well as the phase properties. The GCMS has been widely heralded as a "gold standard" for forensic substance identification because it is used to perform a specific test. A specific test positively identifies the actual presence of a particular substance in a given sample¹.

The genus *Turnera* is one of the most important genera of the family turneraceae comprising more than 100 species grouped in nine series⁵. Which are distributed largely in tropical and subtropical region of Asia and Africa⁵. *Turnera ulmifolia* L. is a polymorphic polyploid complex of perennial weeds commonly called 'Yellow Alder'. This variety is a dense compact shrub that has dark green foliage and bright yellow flowers. *Turnera* is adopted as ornamental plant, being used as foundation, border, mass planting and ground cover⁷. The Turneraceae family occurs in Africa and in the Americas. In Brazil, there are two genera and approximately 80 species. *Turnera ulmifolia* and *T. diffusa* are shrubs usually found in gardens and also used in folk medicine. Distributed throughout Brazil, *T. ulmifolia* is popularly used to treat asthma, rheumatism, indigestion and bronchitis⁸. It has antioxidant and anti-inflammatory properties^{9,10}. *Turnera diffusa* (var. *aphrodisiaca*) is found mainly in

Mexico, where it is considered an aphrodisiac and is used as an astringent, diuretic, expectorant, purgative, stimulant or tonic⁸. Other traditional uses of *Turnera* species include the treatment of anemia, bronchitis, cough, diabetes, fever, fungal disease, pain, pulmonary and respiratory disease, skin disorders, abortive, expectorants, laxative and women's health problems¹¹. Thus, in this study, ethanolic extracts of *Turnera ulmifolia* were evaluated for the phytochemical screening and GC-MS analysis.

2. MATERIALS AND METHODS

2.1 Collection and identification of Plant material

Plants of *Turnera ulmifolia* L. var. *elegans* (Otto) Urb. (= *Turnera subulata* Sm.) Were collected from garden and being identified by Botanical survey of India (BSI) Coimbatore Reference No: BSI/SRC/5/23/2013-14/Tech/408 was collected from the Garden, Department of Botany, Government Arts College, Coimbatore. The leaves, stem and roots were washed thoroughly 2-3 times with running tap water then air dried under shade. The plant materials were grinded and powders were kept in small plastic bags with paper labeling.

2.2 Preparation of extract

The grinded 10g of powdered leaf, stem and root parts of plant was successively extracted using 50 ml of ethanol using the Soxhelt extractor for 8-10 hrs¹². The extract was filtered through Whatmann No.1 filter paper to remove all undissolved matter including cellular materials and other constitutions that are insoluble in the extraction solvent.

2.3 Phytochemical screening

The condensed extracts were used for preliminary screening of phytochemicals such as steroids, tannins, alkaloids and phenols¹³, glycosides, triterpenoids and saponins¹⁴, reducing sugars¹⁵ and flavonoids¹⁶.

2.4 GC-MS Analysis

The GC-MS analysis was carried out using a Clarus 500 Perkin – Elmer (Auto system XL) Gas Chromatograph equipped and coupled to a mass detector Turbo mass gold – Perkin Elmer Turbomass 5.2 spectrometer with an Elite – 5MS (5% Diphenyl /

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95% Dimethyl poly siloxane), 30m x 0.25 µm DF of capillary column. The instrument was set to an initial temperature of 110°C, and maintained at this temperature for 2 min. At the end of this period the oven temperature was rose up to 280°C, at the rate of an increase of 5°C /min, and maintained for 9 min. Injection port temperature was ensured as 200 °C and Helium flow rate as one ml/min. The ionization voltage was 70eV. The samples were injected in split mode as 10:1. Mass spectral scan range was set at 45-450 (m/z). Using computer searches on a NIST Version –Year 2011 were used MS data library and comparing the spectrum obtained through GCMS compounds present in the plants sample were identified.

3. RESULTS

Preliminary phytochemical analysis of ethanolic leaf, stem and root extracts of *Turnera ulmifolia* are presented in the table 1. The phytochemical analysis reveals that the presence of alkaloids, flavonoids, glycosides, phenol, steroids, tannins, and reducing sugar in leaf, flavonoids, glycosides, phenol, saponins, triterpenoids in stem and flavonoids glycosides steroids, tannins and reducing sugar in root extracts.

GCMS analysis revealed the presence of 17 compounds in the leaf extract of *T.ulmifolia* by comparing their retention time and by interpretation of their mass spectra (Fig 1). Among the identified compounds the important bioactive compounds are Toosendanin (42.76%), 4-Dimethylamino [1, 1':3', 1''] terphenyl-4'-yl) Phenylmethanone (18.45%), Methyl 13C hexadecatrienoate (5.48%), Pyranthrene (3.80%) Benzoic acid (2.81%), Neophytadiene (2.40%) and Phytofluene (1.06%). The active principles with their retention time (RT) molecular formula and molecular weight (MW) and peak area in the ethanolic leaf extract of *T.ulmifolia* are presented in Table 2.

4. DISCUSSION

Among the identified phytochemicals, Toosendanin has anti botulism¹⁷ apoptosis induction against hepatocellular carcinoma cells other type of human cancer cells^{18,19} and hepatotoxicity^{20,21}. Neophytadiene, a bioactive principle is also found to be effective in inhibition of cyclooxygenase or lipoxygenase leads to decreased

production of prostaglandins and leukotriene's²². It is also used as antipyretic, analgesic, anti inflammatory, antimicrobial and antioxidant properties²³. Thus, this GCMS analysis is useful to understand the nature of active principles in this medicinal plant and will be helpful for further studies.

5. CONCLUSION

The result of the present analysis reveals that the successive extracts of *T. ulmifolia* possessed biological activity were analyzed by phytochemical screening and GC-MS analysis. The plant extract reveals the presence of alkaloids, flavonoids, glycosides, phenol, saponins, steroids, tannins, triterpenoids and reducing sugars. The GC-MS analysis of the ethanolic extract of *T.ulmifolia* reveals the presence of phytoconstituents were toosendanin, phenylmethanone, pyranthrene, neophytadiene and phytofluene etc. Thus, the medicinal plant *T.ulmifolia* is found to possess significant phytoconstituents. The presence of such a variety of phytochemicals may be attributed to the medicinal characteristics of this plant.

Table 1: Preliminary phytochemical analysis of *Turnera ulmifolia*

S. No	Secondary metabolites	<i>T. ulmifolia</i> ethanolic plant extract		
		Ethanolic leaf extract	Ethanolic stem extract	Ethanolic root extract
1	Alkaloids	+	-	-
2	Flavonoids	+	+	+
3	Glycosides	+	+	+
4	Phenol	+	+	-
5	Saponins	-	+	-
6	Steroid	+	-	+
7	Tannins	+	-	+
8	Triterpenoids	-	+	-
9	Reducing sugars	+	-	+

Fig.1: GC-MS Chromatogram of ethanolic extract of *T. ulmifolia*

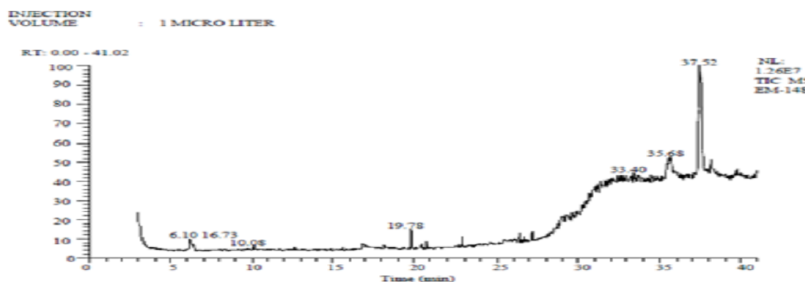


Table 2: Phytocomponents identified in ethanolic extracts of *T. ulmifolia* by GC-MS

S. No	RT	Compound Name	Molecular Formula	Molecular Weight	Peak Area
1	6.16	Methyl 13C hexadecatrienoate	C ₁₇ H ₂₈ O ₂	264	5.48
2	16.82	Benzoic acid	C ₁₇ H ₁₄ C ₁ N	343	2.81
3	19.80	Neophytadiene	C ₂₀ H ₃₈	278	2.40
4	22.81	methylenecyclopropane adduct	C ₂₈ H ₂₄ O	376	2.10
5	27.13	9,12,15-Octadecatrienoic acid, (Z,Z,Z)-	C ₁₈ H ₃₀ O ₂	278	1.06
6	28.98	2,7-Bis[(2R,5R)-2,5-dihydro-2-isopropyl-3,6-dimethoxypyrazin-5-spiro-1,2,3,6,7,8-hexahydro-as-indacene O4	C ₂₈ H ₃₈ N ₄	494	5.32
7	29.31	1-Trichloroacetyl-3,5,7-triphenyl-1H-1,2-diazepine	C ₂₅ H ₁₇ C ₁₃ N ₂ O	466	1.78
8	30.71	2-(Benzyloxy) butyraldehyde	C ₁₁ H ₁₄ O ₂	178	1.78
9	30.98	Pyranthrene	C ₃₀ H ₁₆	376	3.08
10	31.40	Artonin Q	C ₃₁ H ₃₀ O ₈	530	1.05
11	31.63	Phytofluene	C ₄₀ H ₆₂	542	1.06
12	33.42	1,8-Di(2-pyrenyl)naphthalene	C ₄₂ H ₂₄	528	1.22
13	33.73	m-Bis(3,4-diamino-2,5-diphenyl-6 pyridino) benzene	C ₄₀ H ₃₂ N ₆	596	2.56
14	35.68	(4-Dimethylamino[1,1':3',1''] terphenyl-4'-yl) phenylmethanone	C ₂₇ H ₂₃ NO	377	18.45
15	37.52	Toosendanin	C ₃₀ H ₃₈ O ₁₁	574	42.76
16	38.19	7-Benzyloxy-6-(tert-butyl)dimethylsiloxy)-10-methylene-13,14	C ₃₆ H ₄₅ NO	647	3.24
17	39.82	Tetramethyltetraphenylcyclotetrasiloxane	C ₂₈ H ₃₂ O ₄	544	3.85

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