

COMPARATIVE PHYTOCHEMICAL PROFILES OF TWO ACCESSIONS OF *MEMECYLON EDULE* ROXB. (MELASTOMATACEAE) BY GC-MS ANALYSIS

Saravanakumar, K.

Botany Wing -DDE, Annamalai University, Annamalainagar-608002, Tamil Nadu, India.

ABSTRACT

Memecylon edule Roxb. a member of Melastomataceae and a valuable Indian ethnomedicinal plant and there are two accessions of this species was investigated to determine the phytochemical constituents present in various extracts of the leaves through GC-MS analysis. Powdered leaf plant materials were subjected to successive extraction with organic solvents such as methanol by Soxhlet extraction method. In the present study, a total of phytochemicals, twenty eight from Acc.1 and twenty five from Acc.2 were identified by GC-MS analysis using methanolic leaf extract, all the identified compounds were medicinally valuable for the treatment of various human ailments. In addition, all the phytochemical compounds were needed for further investigations on toxicological aspects for the development of new lead of therapeutic interest.

Keywords: Phytochemical profile, *Memecylon edule*, GC-MS analysis.

1. INTRODUCTION

The genus *Memecylon* L., belonging to the family Melastomataceae, is represented world over by around 250 species of shrubs and trees in the paleotropical region. Of which 30 species has been reported from India (Henry *et al.*, 1989; Santapau and Henry, 1973) and 16 species from Tamil Nadu state (Nair and Henry, 1983). Also the genus *Memecylon* is represented by 39 species of which 21 are endemic to the country and the Western Ghats is reported to host 29 species (Viswanathan and Manikandan, 2001; Santhosh Kumar *et al.*, 2003; Rajendraprasad *et al.*, 2006; Murugan and Gopalan, 2006; Manickam *et al.*, 2007). They are distributed in all types of habitats (Sivu *et al.*, 2013). *Memecylon* species are utilized worldwide as timbers, ornamentals, source of edible fruits and yellow dye in addition to their medicinal properties (Mabberley, 2005).

The leaves of *M. edule* is used to heal the burning wounds without scar. The anti-inflammatory, analgesic and antioxidant activities of the leaves used in traditional medicine in reliving inflammation and pain (Nuwalkew *et al.*, 2009). Decoction of stem has also been relief fever symptoms of common diseases such as common cold, measles and chicken box (Karuppawamy, 2007). The antibacterial activity of seeds were evaluated (Elavazhagan and Arunachalam, 2010). After pursuit of published literature, so far meager work has been done regarding the phyto-chemical evaluation on this selected plant. Hence, in the present study GC-MS analysis was carried out with methanol extracts of the leaves of two accessions of

Memecylon edule Roxb. to examine the chemical constituents present in it.

2. MATERIALS AND METHODS

2.1. Collection of plant materials and preparation of the extract

The fresh leaves of *Memecylon edule* were collected from Acc.1. Authukurichi (Lat, 11.35 °N; Long, 79.31°E), Ariyalur District and Acc.2. Puthupattu, (12°05'74"N, 79°86'93"E) Villupuram District, Tamil Nadu, India. The specimen was botanically identified and confirmed by Rapinat Herbarium, St. Joseph's College, Tiruchirappalli. The preserved plant specimens were submitted to the Department of Botany, Annamalai University, Annamalainagar, Tamil Nadu for further reference. The leaves were chopped into small pieces, shade-dried and coarsely powdered by using a pulverizer. The powdered leaf were subjected to successive extraction with organic solvents such as hexane chloroform and ethanol by Soxhlet method (Catherine *et al.*, 1997). The extracts were then collected and distilled off on a water bath at atmospheric pressure and the last trace of the solvents was removed in vacuo and stored at 4°C. They were used for GC-MS analysis.

2.2. Gas chromatography- mass spectrometry (GC-MS) analysis

GC-MS analysis was performed with GC-MS Clarus 500 Perkin Elmer Equipment. Compounds were separated on Elite-5 capillary column (Crossbond 5% Phenyl 95% dimethylpolysiloxane) Oven temperature was programmed as follows:

isothermal temperature at 60°C then increased to 200°C at the rate of 10°C/min., then increased up to 280°C at the rate of 5°C/min. held for 9 min. Ionization of the sample components was performed in the Electron energy (70 eV). The helium was used as gas carrier (1ml/min.), and 1.0µL of sample was injected. The detector was Mass detector Turbomass gold Perkin Elmer. The total running time for GC was 36 min. and software Turbomass 5.2.0 was used in this GC-MS study (Manjamalai *et al.*, 2010).

2.3. Identification of compounds

All the compounds were identified from methanol extracts based on direct comparison of the retention times and their mass spectra with the spectra of known compounds stored in the spectral database, National Institute Standard and technology (NIST) (Version year 2005).

3. RESULT AND DISCUSSION

The chemical constituents identified by the GC-MS analysis on methanolic leaf extract of two accessions of *Memecylon edule* were enumerated along with Molecular Formula (MF), Molecular Weight (MW), Retention Time (RT), and Peak area and Peak area (%) is presented in Table-1. Of which nine compounds present in both the accessions of *M. edule* and are Furfural, Levoglucosenone, 1-Deoxy-d-altritol, 4H-Pyran-4-one, 2,3-dihydro-3,5-,1,4,3,6-Dianhydro-à-d-glucopyranose,1,2,3-Benzenetriol, 3, 7,11,15-Tetramethyl-2-hexadecen-1-ol and n-Hexadecanoic acid. Comparatively 1,2,3-Benzenetriol show higher percentage in both accessions.

Table 1. Phytochemicals identified from the methanolic leaf extract of *M. edule*. (Acc.1. Authukurichi, Acc.2. Puthupattu)

Sl.No.	Compound name	Formula	Mol. weight	Acc.1.	Acc.2
				% of peak area	% of peak area
1	Furfural	C ₅ H ₄ O ₂	96	5.5959	1.5145
2	2-Cyclopenten-1-one, 2-hydroxy-	C ₅ H ₆ O ₂	98	0.3292	-
3	1-Benzoyl-3-amino-4-cyano-3-pyrroline	C ₁₂ H ₁₁ N ₃ O	213	0.8871	-
4	2(3H)-Furanone, 3-acetyldihydro-	C ₆ H ₈ O ₃	128	0.2274	-
5	Phentermin-propionyl	C ₁₃ H ₁₉ NO	205	0.6349	-
6	cis-1,2-Dihydrocatechol	C ₆ H ₈ O ₂	112	0.392	-
7	1,2-Butanediol, 1-phenyl-	C ₁₀ H ₁₄ O ₂	166	4.2074	-
8	Hydrouracil, 1-methyl-	C ₅ H ₈ N ₂ O ₂	128	0.9593	-
9	Methyl 2-furoate	C ₆ H ₆ O ₃	126	0.8868	-
10	Levoglucosenone	C ₆ H ₆ O ₃	126	2.2612	0.179
11	1-Deoxy-d-altritol	C ₆ H ₁₄ O ₅	166	0.224	0.7361
12	4H-Pyran-4-one, 2,3-dihydro-3,5-	C ₆ H ₈ O ₄	144	2.6392	1.457
13	Benzoic acid, 2-hydroxy-, methyl ester	C ₈ H ₈ O ₃	152	0.1067	-
14	1,4:3,6-Dianhydro-à-d-glucopyranose	C ₆ H ₈ O ₄	144	1.4487	0.5732
15	2-Furancarboxaldehyde, 5-(hydroxymethyl)-	C ₆ H ₆ O ₃	126	13.488	-
16	2-Methoxy-4-vinylphenol	C ₉ H ₁₀ O ₂	150	0.3241	-
17	Hydroquinone	C ₆ H ₆ O ₂	110	7.3113	-
18	Methyl-à-d-ribofuranoside	C ₆ H ₁₂ O ₅	164	0.6927	-
19	1,2,3-Benzenetriol	C ₆ H ₆ O ₃	126	29.278	17.066
20	1,3-Cyclohexanediol, 4,6-dimethyl-2-nitro-, diacetate (ester),	C ₁₂ H ₁₉ NO ₆	273	0.3964	-
21	Dodecanoic acid	C ₁₂ H ₂₄ O ₂	200	0.2861	-
22	D-Allose	C ₆ H ₁₂ O ₆	180	15.256	16.808
23	Benzeneacetic acid, 4-hydroxy-3-methoxy-	C ₉ H ₁₀ O ₄	182	2.7237	-
24	2-Cyclohexen-1-one, 4-(3-hydroxybutyl)-3,5,5-trimethyl-	C ₁₃ H ₂₂ O ₂	210	1.9662	-
25	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	C ₂₀ H ₄₀ O	296	0.6571	0.1904
26	3,5-Dimethoxy-4-hydroxyphenylacetic acid	C ₁₀ H ₁₂ O ₅	212	0.6745	-
27	n-Hexadecanoic acid	C ₁₆ H ₃₂ O ₂	256	5.168	9.6491
28	cis-9-Hexadecenal	C ₁₆ H ₃₀ O	238	0.9771	-
29	2,10-Dodecadien-1-ol, 3,7,11-trimethyl-,	C ₁₅ H ₂₈ O	224	-	3.2083

30	2H-1-Benzopyran-2-one, methyl-2-oxobutyl)-	7-methoxy-6-(3-	$C_{15}H_{16}O_4$	260	-	0.2698
31	Octadecanoic acid		$C_{18}H_{36}O_2$	284	-	1.0947
32	E-9-Tetradecenoic acid		$C_{14}H_{26}O_2$	226	-	4.1895
33	2H,8H-Benzo[1,2-b:5,4-b']dipyran-2-one, 8,8-dimethyl-		$C_{14}H_{12}O_3$	228	-	0.2698
34	Tetradecanoic acid		$C_{14}H_{28}O_2$	228	-	0.3379
35	Benzeneacetic acid, 3-methoxy-, methyl ester	4-hydroxy-	$C_{10}H_{12}O_4$	196	-	0.1605
36	1,6-Anhydro- α -D-Galactofuranose		$C_6H_{10}O_5$	162	-	10.409
37	7-Oxabicyclo[4.1.0]heptane, (1,3-dimethyl-1,3-butadienyl)-2,2,6-trimethyl-, (E)-	1-	$C_{15}H_{24}O$	220	-	1.7445
38	1-Hydroxy-6-(3-isopropenyl-cycloprop-1-enyl)-6-methyl-heptan-2-one		$C_{14}H_{22}O_2$	222	-	0.14
39	2-Methoxy-4-vinylphenol		$C_9H_{10}O_2$	150	-	0.1694
40	2-Furancarboxaldehyde, (hydroxymethyl)-	5-	$C_6H_6O_3$	126	-	9.3267
41	Sucrose		$C_{12}H_{22}O_{11}$	342	-	2.1644
42	5H-1,4-Dioxepin,2,3-dihydro-2,5-dimethyl-		$C_7H_{12}O_2$	128	-	1.5161
43	2(1H)-Pyridinone, 6-hydroxy-		$C_5H_5NO_2$	111	-	0.2702
44	2-Ethylacrolein		C_5H_8O	84	-	0.1516

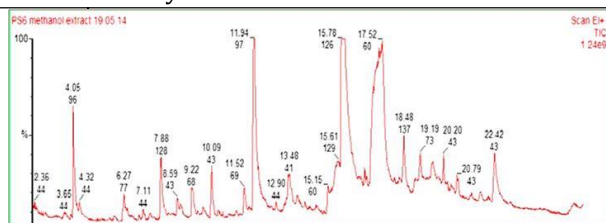


Fig. 1. GC-MS Chromatogram of methanolic leaf extract of *M. edule* (Acc.1. Authukurichi).

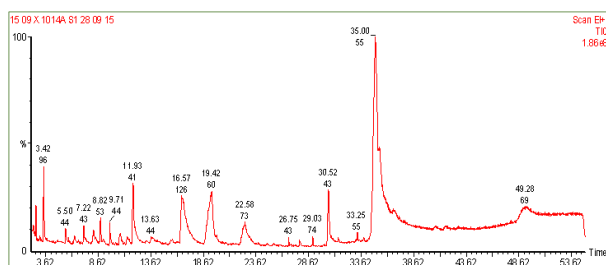


Fig. 2. GC-MS Chromatogram of methanolic leaf extract of *M. edule* (Acc.2. Puthupattu).

Plants serve as vast source for varied phytoconstituents exhibiting varied pharmacological property. Identifying such potential plants is of significance in medicine. In this connection, in the present study the methanolic leaf extract of two accessions of *M. edule* contains various phytochemicals. Secondary metabolites have proven to be medicinal in nature. They have various protective and therapeutic effects, which prevent diseases and maintain a state of well-being (Oyetayo, 2007).

These compounds are known to be biologically active. Tannins have been found to form irreversible complexes with proline-rich proteins (Hagerman and Butler, 1981) resulting in the inhibition of the cell protein synthesis. Tannins have important roles such as stable and potent antioxidants (Trease and Evans, 1983). Herbs that have tannins as their main component are astringent in nature and are used for treating intestinal disorders such as diarrhoea and dysentery (Subhuti Dharmananda, 2003). Presence of Hexadecanoic acid, showing Antioxidant, Antiandrogenic, Hypocholesterolemic activities and used as nematocide, pesticide, lubricant, also it is an hemolytic 5-Alpha reductase inhibitor. Flavonoids have been referred to as nature's biological response modifiers because of strong experimental evidence of their inherent ability to modify the body's reaction to allergen, virus and carcinogens. They show anti-allergic, anti-inflammatory, anti- microbial and anti-cancer activity (Cushnie and Lamb, 2005; De Sousa *et al.*, 2007).

Tannins are known to possess general antimicrobial and antioxidant activities (Rievere *et al.*, 2009). Recent reports show that tannins may have potential value as cytotoxic and antineoplastic agents (Aguinaldo *et al.*, 2005). Other compounds like saponins also have anti-fungal properties (Mohanta *et al.*, 2007). Saponins are a mild detergent used in intracellular histochemistry staining to allow antibody access to intracellular proteins. In medicine, it is used in hyper cholestrolaemia, hyperglycemia, antioxidant, anticancer, anti-

inflammatory and weight loss, etc. It is also known to have anti-fungal properties (De-Lucca *et al.*, 2005). Saponins have been implicated as bioactive antibacterial agents of plants (Mandal *et al.*, 2005; Manjunatha, 2006). Plant steroids are known to be important for their cardiostimulant activities, possess insecticidal and anti-microbial properties. Plant derived natural products such as flavonoids, terpenoids and steroids etc have received considerable attention in recent years due to their diverse pharmacological properties including antioxidant and antitumor activity. Phenolic phytochemicals have antioxidative, antidiabetic anticarcinogenic, antimicrobial, antiallergic, antimutagenic and anti-inflammatory (Arts and Hollman, 2005; Scalbert *et al.*, 2005). The present report correlates along with the above bioactivities and phytocompounds by the earlier reports in the leaf extracts of *Memecylon umbellatum* (Murugesan *et al.*, 2011; Bharathi *et al.*, 2015).

4. CONCLUSION

The presence of various bioactive compounds present in the leaves of *M. edule* justifies the use of for various ailments by traditional practitioners. However, isolation of individual phytochemical compound will subjecting it to biological activity will definitely give fruitful results. It could be concluded that *Memecylon edule* contains various bioactive compounds. However, further studies will need to be undertaken to ascertain fully its bioactivity, toxicity profile, effect on the ecosystem and agricultural products.

REFERENCES

Aguineldo, A.M., El-Espeso, B.Q. Guovara and M. Nanoto, (2005). Phytochemistry. In: Guevara, BQ. (eds.), A guide book to plant screening phytochemical and biological. Manila: University of Santo Tomas.

Arts, I.C. and P.C. Hollman, (2005). Polyphenols are disease risk in epidemiological studies. *Amer. J. Clin. Nut* **81**: 317-325.

Bharathi, T.R., M.C. Madhusudhan, P.M. Pradeep Kumar, S. Chandra Nayaka and H.S. Prakash, (2015). Antimicrobial Potential of *Memecylon L.* species from Western Ghats against clinical isolates of pathogenic bacteria. *Research J. Pharm. Biol. Chem. Sci* **6**(4): 1280-1287.

Catherine, A., E. Rice, J.M. Nicholas and P. George, (1997). *Trends Plant Sci* **2**(4): 152-158.

Cushnie, T.P.T. and A.J. Lamb, (2005). Antimicrobial activity of flavonoids. *Int. J. Antimicrob. Agents* **26**(5): 343-356.

De Sousa, R., R. Queiroz, K.C. Souza, A.C. Gurgueira, S.A. Augusto, A.C. Miranda, M.A. *et al.* (2007). Phosphoprotein levels, MAPK activities and NF kappa B expression are affected by fisetin. *J. Enzyme Inhib. Med. Chem* **22**(4): 439-444.

De-Lucca, A., T. Cleveland, K. Rajasekara, S. Boue and R. Brown, (2005). Fungal properties of CAY-1, a plant saponin, for emerging fungal pathogens. 45th inter science conference in antimicrobial agents and chemotherapy abstract.; p. 180.

Elavazhagan, T. and K.D. Arunachalam, (2010). Phytochemical and antibacterial studies of seed extract of *Memecylon edule*. *Int. J. Eng. Sci. Tech* **2**(4): 498-503.

Hagerman, A.E. and I.G. Butler, (1981). *J. Biol. Chem* **256**: 4494-4497.

Henry, A.N., V. Chithra, and N.P. Balakrishnan, (1989). Flora of Tamil Nadu. Series 1. Vol. 3. Botanical Survey of India, Coimbatore, India.

Karuppawamy, S. (2007). Medicinal plants used by Paliyan tribes of Sirumalai hills of Southern India. *Indian Nat. Prod. Rad* **6**: 436-442.

Mabberley, D.J. (2005). The Plant Book, 2nd (eds.), Cambridge University Press, UK: p. 449.

Mandal, P., S.P. Sinha Babu and N.C. Mandal, (2005). Antimicrobial activity of Saponins from *Acacia auriculiformis*. *Fitoterapia* **76**(5): 462-565.

Manickam, V.S., C. Murugan, G.J. Jothi and V. Sunderesan, (2007). *Memecylon courtallense* - A new species (Melastomataceae) from Courtallam Hills of Tamil Nadu, India. *Indian J. For* **30**(1): 77-80.

Manjamalai, A., R.S.S. Singh, C. Guruvayoorappan and V.M. Berlin Grace, (2010). *Global J. Biotechnol. Biochem* **5**(2): 120-128.

Manjunatha, B.K. (2006). Antibacterial activity of *Pterocarpus santalinus*. *Ind. J. Pharm. Sci* **68**(1): 115-116.

Mohanta, T.K., J.K. Patra, S.K. Rath, D.K. Pal and H.N. Thatoi, (2007). Evaluation of antimicrobial activity and phytochemical screening of oils and nuts of *Semicarpus anacardium L.f.* *Sci. Res. Essay* **2**(11): 486-490.

Murugan, C. and R. (2006). Gopalan Four new additions to Indian *Memecylon L.* (Melastomataceae) from South India. *Indian J. For* **29**(1): 105-108.

Murugesan, S., R. Vijayakumar and A. Panneerselvam, (2011). Evaluation of

- Phytochemical Constituents from the Leaves of *Memecylon umbellatum* Burm.f. *Research J. Pharm. Biol. Chem. Sci* **2**(4): 1145-1152.
- Nair, N.C. and A.N. Henry, (1983). Flora of Tamil Nadu. Ser. 1. Vol. 1. Botanical Survey of India, Coimbatore, India.
- Nualkew, S., K. Rattanmanee, A. Thongpraditchote, Y. Wongkrajang and A. Nahrstedt, (2009). Anti-inflammatory, analgesic and wound healing activities of the leaves of *Memecylon edule* Roxb. *J. Ethnopharmacol* **121**(2): 278-281.
- Oyetayo, V.O. (2007). Comparative studies of the phytochemical and antimicrobial properties of the leaf, and tuber of *Anchomanes difformis*. *J. Pharmacol. Toxicol* **2**(4): 407-410.
- Rajendraprasad, M., S.L. Prathapan, A.G. Pandurangan and T. Shaju, (2006). *Memecylon royenii* Blume. (Melastomataceae): A new record for India. *Indian For* **132**(2): 229-232.
- Rievere, C., J.H. Van Nguyen, L. Pieters, B. Dejaegher, Y.V. Heyden and C.V. Minh, *et al.* (2009). Polyphenols isolated from antiradical extracts of *Mallotus metcalfeanus*. *Phytochem* **70**: 86-94.
- Santapau, H. and A.N. Henry, (1973). A Dictionary of Flowering Plants in India. Council of Scientific and Industrial Research, New Delhi; pp. 1-198.
- Santhosh Kumar, E.S., R. Antony and A.C. Shanavas Khan, (2003). *Memecylon agastyamalaianum* (Melastomataceae), a new species from India. *Bot. Bull. Acad* **44**: 175-177.
- Scalbert, A., C. Manach, C. Morand, C. Remesy and L. Jimenez, (2005). Dietary polyphenols and the prevention of diseases. *Cri. Rev. Food Sci. Nutr* **45**: 287-306.
- Sivu, A.R., N.S. Pradeep, K.B. Rameshkumar and A.G. Pandurangan, (2013). Evaluation of phytochemical, antioxidant and antimicrobial activities of *Memecylon* L. species from Western Ghats. *Indian J. Nat. Prod. Res* **4**(4): 363-370.
- Subhuti Dharmananda, (2003). Gallnuts and the Uses of Tannins in Chinese Medicine- A paper delivered at Institute for Traditional Medicine, Portland, Oregon.
- Trease, G.E. and W.C. Evans, (1983). Textbook of Pharmacognosy 12th (eds.). Balliere, Tindall, London.; pp. 343-383.
- Viswanathan, M.B. and U. Manikandan, (2001). A new species, *Memecylon mundanthuraianum* of Melastomataceae from India. *Nordic J. Bot* **21**(3): 259-262.