Journal of Innovative Agriculture
Research Article

Phytochemical analysis through GC-MS in *Mimosa pudica*

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Volume: 11, Issue: 1, Pages: 12-17
DOI: https://doi.org/10.37446/jinagri/rsa/11.1.2024.12-17
Received: 01 October 2023 / Accepted: 28 December 2023 / Published: 31 March 2024

Background: The aim of the study to identify the photochemical present in the *Mimosa pudica* plant present in the premises of SRM College of Agricultural Sciences, Chengalpattu district, Tamil Nadu, India.

Methods: Leaves, stem and root samples were used for the methanol extraction and the crude extract was subjected into the GCMS analysis.

Results: The results revealed the presence of Mome inositol; Guanosine; 3-o-methyl-D-fructose; Ether butyl isopentyl; Methyl.beta.-d-ribofuranoside; 3,4-Dichloroatropine etc., in the plant parts.

Conclusion: This study to be carried out to find out the maximum number of compounds present in this plant through the derivatization process.

Keywords: *Phytochemical, GC-MS, Mimosa pudica, medicinal plant, metabolite profiling*

Introduction

Mimosa pudica L. (Family: Fabaceae), a renowned ornamental plant, is commonly recognized by a multitude of names including sleeping grass, sensitive plant, humble plant, shy plant, touch-me-not, chuimui, and lajwanti. The plant's popularity in the realm of ornamentation stems from its intriguing thigmonastic and seismonastic behaviors. These physiological responses entail leaf closure and petiole drooping, orchestrated in reaction to an array of stimuli such as light variations, vibrations, wounds, air currents, tactile contact, as well as temperature fluctuations encompassing both warmth and coldness (Volkov et al., 2010a, b; Soetedjo et al., 2015). This particular plant reportedly possesses a sour and puckering flavor and has been historically employed to address different health issues. While the leaves are the most frequently utilized plant component for this intention, the flowers, bark, and fruits also hold significance in traditional medicine (Sriram et al., 2011). The *M. pudica* is recognized and appreciated for its pain-relieving, anti-inflammatory (Prasanna et al., 2009), blood sugar reducing (Amalraj & Ignacimuthu, 2002), diuretic, puckering, muscle-relaxing, and blood-cleansing (Ghani, 2003) properties. As a result, it has been employed to address hypertension (Aalok, 1997), menorrhagia, and leucorrhea (Hemadri & Rao 1983; Vaidya & Sheth, 1986). Applying a paste made from the entire plant can be effective in treating wounds while using a paste derived from the leaves can help with eczema (Singh & Singh, 2009). Both leaves and roots are employed in the treatment of hemorrhoids (Ghani, 2003). It also has various other pharmacological advantages like antifertility (Valsala & Karpagagaanapathy, 2002; Ganguly et al., 2007), and antidiarrheal (Balakrishnan et al., 2006a). Antiparasitic (Marimuthu et al., 2011) and antimicrobial potentials (Ambikapathy & Gomathi, 2011; Mohan et al., 2011; Tamilarasi & Anathi, 2012). A research has indicated that *Mimosa pudica* has been utilized to calm the mind, alleviate depression, mental unease, irritability, and memory loss.

Furthermore, it is employed to boost mood, enhance blood circulation, foster proper cell development, and hinder hair loss. In Western medicine, its root was employed for addressing insomnia, premenstrual syndrome, hemorrhoids, and whooping cough. The exploration of the biochemical content of medicinal plants encompasses the intricate examination of the extract obtained. The intricate array of chemical compounds across diverse groups of secondary metabolites in these plants creates difficulties in both identifying and quantifying components within the sample. Hence, the application of accurate and trustworthy analytical techniques assumes paramount importance in studying these samples within the domain of natural and phytotherapeutic products. One of the pre-eminent analytical techniques involved in the biochemical profiling of medicinal plants is GCMS. Gas chromatography-mass spectrometry (GC-MS) is the combination of two analytical methods to separate and identify various extracts to be tested. Gas chromatography is used to differentiate the components of a mixture in peak area %. Mass spectrometer was used to identify and structural elucidation of all the chemical compounds. Numerous research investigations focusing on various *Mimosa* genus species reveal findings related to the separation and recognition of organic substances. Aguiar et al. (2012) extracted the subsequent substances from *Mimosa invisa*: pinoresinol, salicifoliol, quercetin, sitosterol, β-amyrin, p-hydroxy coumaric acid, 4-hydroxy-3,5-dimethoxy benzaldehyde, 4-hydroxy-3-methoxy benzaldehyde (vanillin), 4-hydroxy-3-methoxy benzoic acid, and 4′,6,7-trimethoxy flavonol. Cruz et al. (2016) Successfully extracted a variety of flavonoids, including 5,4′-dihydroxy-7-methoxyflavanone, 5,7,4′-trihydroxy-3-methoxyflavone, 5,4′-dihydroxy-7,8-dimethoxyflavone, 5,7,4′-trihydroxy-6-methoxyflavonol, and 5-hydroxy-7,8,4′-trimethoxyflavonol, from the leaves of *M.tenuiflora* through their research efforts. In the aqueous extract of *M. tenuiflora* bark, Rivera-Arce and colleagues detected the presence of saponins and tannins, as outlined in their research study. Researchers successfully isolated the compound 2-(2′,6′-dimethyl-3′,4′,5′-alkyl)-3-oxy-(alkyl or hydroxy alkyl)-5,7-dihydroxy-chromen-4-one from the entire *Mimosa pudica* plant. Hence, this current research was conducted to explore the chemical elements of *Mimosa pudica* L. using Gas Chromatography Mass Spectrometry (GC-MS). We have used the methanolic extract of the leaf, stem and root samples of touch-me-not plant for GC-MS analysis.

Materials and Methods

Mimosa pudica (including root) healthy and disease free plants were collected from the premises of SRM College of Agricultural Sciences, Vendhar Nagar, Baburayanpettai, Chengalpattu district. Leaves, stems and roots are separated and shade dried for seven days. Four grams of powdered samples (leaf, stem, and root) in a test tube were taken and then 40 ml of methanol was added in each test tube. Shacked and covered with aluminum foil and incubated it for 24 hours. Whatman 1 filter paper was used to filter the extract. Then the crude extracts were used to detect various biochemical compounds by Gas Chromatography - Mass Spectrometry (GC-MS) (Tunna et al., 2015) at Nanotechnology Research Centre (NRC), SRMIST.

Results

GCMS analysis of methanolic extract of *Mimosa pudica* revealed different phytochemical compounds in the leaf (Table 1), stem (Table 2) and root (Table 3) (detailed results are in the supplementary file). Also, the plant samples reported with 3-o-methyl- D-fructose; Ether, butyl isopentyl; Guanosine, 1,2,3-propanetriol, diacetate; 1,3-cyclohexane-1,3-d2-diamine, cis-; etc., (complete GCMS analysis result is given as supplementary file)

Table 1. Compounds identified in the methanolic leaf extract of *Mimosa pudica* in GC-MS

RT	Name of the compound	Molecular formula	Molecular weight	Peak area %
18.487	Mome inositol	$C_7H_{14}O_6$	194	32.12
18.255	3-o-methyl- D-fructose	$C_7H_{14}O_6$	194	31.43
17.76	Ether, butyl isopentyl	$C_9H_{20}O$	144	10.44
14.53	Guanosine	$C_{10}H_{13}N_5O_5$	283	3.87
18.95	4-o-methylmannose	$C_7H_{14}O_6$	194	2.22
25.448	(z)-3-(pentadec-8-en-1-yl)phenol	$C_{21}H_{34}O$	302	1.47
19.214	3,7,11,15-tetramethyl-2-hexadecen-1-ol	$C_{20}H_{40}O$	296	1.23
22.083	Phytol	$C_{20}H_{40}O$	296	1.11
9.36	Acetic acid, pentyl ester	$C_7H_{14}O_2$	130	0.53
16.504	1,2-benzenedicarboxylic acid, diethyl ester	$C_{12}H_{14}O_4$	222	0.5
9.425	2-propanone, 1-(1,3-dioxolan-2-yl	$C_6H_{10}O_3$	973	0.49
4.968	Methyllaurate	C_8H_{10}	106	0.43

Table 2. Compounds identified in the methanolic stem extract of *Mimosa pudica* in GC-MS

RT	Name of the compound	Molecular formula	Molecular weight	Peak area %
18.49	Mome inositol	$C_7H_{14}O_6$	194	66.75
14.89	Guanosine	$C_{10}H_{13}N_5O_5$	283	18.18
11.695	1,2,3-propanetriol, diacetate	$C_7H_{12}O_5$	176	1.14
9.365	1,3-cyclohexane-1,3-d2-diamine, cis-	$C_6H_{12}D_2N_2$	116	0.85

Table 3. Compounds identified in the methanolic root extract of *Mimosa pudica* in GC-MS

RT	Name of the compound	Molecular formula	Molecular weight	Peak area %
18.49	Mome inositol	$C_7H_{14}O_6$	194	66.75
14.89	Guanosine	$C_{10}H_{13}N_5O_5$	283	18.18
11.695	1,2,3-propanetriol, diacetate	$C_7H_{12}O_5$	176	1.14
9.365	1,3-cyclohexane-1,3-d2-diamine, cis-	$C_6H_{12}D_2N_2$	116	0.85
10.255	Propanoic acid, 2-methyl-	$C_4H_8O_2$	88	0.74
10.315	1,3-dioxolane-2-methanol	$C_4H_8O_3$	104	0.64
10.1	1,3-dioxolane, 2,4,5-trimethyl-	$C_6H_{12}O_2$	116	0.59
12.75	2-methoxy-4-vinylphenol	$C_9H_{10}O_2$	150	0.59
16.865	1-butanol, 3-methyl-	$C_5H_{12}O$	88	0.53
16.5	1,2-benzoldicarbonsaeure, di-(hex-1-en-5-yl-ester)	$C_{20}H_{26}O_4$	330	0.46
10.455	Propane	C_3H_8	44	0.45

Discussion

The presence of Mome inositol was recorded in all three samples and it is a polysaccharide compound possessing anti-proliferative, anti-alopecic, anti-cirrhotic and anti-neuropathic (Das et al., 2014) activities. Previous biochemical studies in *Mimosa pudica* revealed the presence of many alkaloids, Mimosin (non-protein), flavonoids, glycosides, sterols, terpenoids, tannins and fatty acids (Kirk et al., 2003, Bum et al., 2004, Dinda et al., 2006). *M. rubicaulis* was shown to produce flavanoid and glycosides. The discovered component was useful for antifertility activity (Norton, 1978) and very effective in the treatment for snakebites (Mahanta & Mukherjee, 2001). Gas Chromatography – Mass Spectrometry (GC-MS) is a method that combines the features of gas chromatography and mass spectrometry for identifying of various components present in the given test sample based on their retention time (RT) (Kell et al., 2005). Nowadays, GC-MS has become a technical platform for profiling secondary metabolite in all the plant and non-plant materials (Fernie et al., 2004). In this report, retention time (RT), molecular formula, molecular weight (MW), peak area% gives the presence of thirteen bio-active phytochemical compounds using the methanolic extract of *Mimosa Pudica*. The presence of different biochemical on the methanol leaf extract are used for efficient wound healing and also in arresting wound bleeding (Chinmoy & Nongmaithem, 2019). Hafsa et al. (2012) found the presence of many phytocompounds like terpenoids, flavonoids, glycosides, alkaloids, quinines, phenols, tannins, saponins, and coumarins in *M. pudica* methanolic extract obtained from leaf sample. Among the identified bio-chemicals are Acetamide, N-methyl-N-[4-[4-fluoro-1-hexahydropyridyl]-2-butynyl]-, Gentamicin and mannosamine have antioxidant and antimicrobial activities (Hussein et al., 2019). Compounds with acetamide link exhibits many applicants, those are well noted. The acetamide functional group is responsible for antimicrobial (Berest et al., 2011) antioxidant and anti-inflammatory (Autore et al., 2010). The acetamides and their analogues all are experimented as chemotherapeutic agents (McCarthy et al., 2009 and Liu et al., 2012). In our report of GC-MS analysis of methanol extract of leaf, stem and root of touch me not plant shows the presence of various bio-chemicals. Same like our estimation, the GC-MS analyses is done in various parts of many medicinal crops like leaf, flower and stem of mountain knotgrass (*Aerva lanata*) (Vidhya & Udayakumar, 2015), leaf and stem of water clover (*Marsilea minuta* L.) (Sabithira & Udayakumar, 2017), leaf and stem of Pepperwort (*Marsilea quadrifolia*) (Gopalakrishnan & Udayakumar, 2014) and leaf, fruit and latex of croton bonplandianus baill (*Croton bonplandianum*)(Vennila & Udayakumar, 2015) also reported many phyto-compounds. With reference to Dr. Duke's Phytochemical and Ethnobotanical report, the bioactive compounds of ethanolic extract of leaf and root of *M. pudica* have many pharmacological activities. The isolation of bio-active compounds in leaf, stem and root of touch me not plants can be utilised for the production of drugs to control diseases.

Conclusion

The presence of various bio-chemical compounds has been detected using GC-MS analysis in the crude methanol extract of leaf, stem and root of naturally available *Mimosa pudica* plant in SRMCAS premises. The same study is to be extended further with the derivatization process to identify the maximum numbers of phytochemical compounds.

Acknowledgment

We acknowledge the Nanotechnology Research Centre (NRC), SRMIST for providing the research facilities

Author contributions

GS framed the research programme and corrected the manuscript. LA, GP, TARS, NT and JS are carry out the experiments and produced the article draft. AS, BRR and DA helped in writing this manuscript.

Funding

No funding

Conflict of interest

The author declares no conflict of interest. The manuscript has not been submitted for publication in any other journal.

Ethics approval

Not applicable

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