

GC-MS Volatile Phytochemicals Profile of *Argemone mexicana* Leaves Methanol Extract

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Abstract

The current work was conducted to identify the secondary metabolites of methanol extract of *Argemone mexicana* leaves using Gas Chromatography Mass Spectroscopy (GC-MS) and to review some of their medicinal implication to humans. The leaves extract was prepared with methanol and analyzed by Mass Hunter Gas chromatography and Mass Spectroscopy (GC-MS). Fifteen bioactive phytochemical compounds were identified. The detected phytochemical compounds were tabulated as peak area, retention time, molecular weight, molecular formula. The analysis revealed the presence of 1-Cyclohexyl-1-propyne, Cyclobutanone, 2-methyl-2-oxiranyl, E-9-Tetradecenal, Undecanoic acid isopropyl ester, Benzenamine, 2,6-dichloro, bicyclo [2.2.1] heptan-2-ol, 1-Heptyn-3-ol, 1-Heptanol, 6-methyl, Carbonic acid, but-3-en-1-yl decyl ester, 2-Methylenecyclohexanol, Arachidonic acid, TMS derivative, 10-Undecenoic acid, TMS derivative, Cyclopentane, 1,3-dimethyl, Dodecanoic acid, TMS derivative, and Palmitic Acid, TMS derivative where palmitic acid TMS derivative showed highest % peak area which was about 28.04% followed by Dodecanoic acid, TMS derivative which showed 14.63 as % peak area, and Carbonic acid, showed the lowest % peak area as 0.29. Therefore, Palmitic acid is more abundance in the extract due to it tallest peak.

Keywords: *Argemone mexicana*; Secondary Metabolites; Gas Chromatography; Mass Spectroscopy; Phytochemical

Introduction

New synthetic drugs of plant derivation and new methods of producing them will continue to be an important and interesting area that should be explored for the discovery and development of new and safer drugs [1]. Healthier cultural acceptability, better compatibility with the human body and lower incidence of side effects are the known attributes of herbal medicine, accounting for 70 to 80% of the world population mainly in the developing countries [2]. In human health, Phytochemicals play a vital role in its protection at significant dietary intake, of which more than 4000 phytochemicals are catalogued [3]. Phytochemicals accumulate in different parts of plants such as root, stem, leaves and seeds [4]. Generally, plant chemicals that protect plant cells from environmental hazards are called phytochemicals [5]. The genus *Argemone* belongs to Papaveraceae family and it consists about 32 species. *A. mexicana* is originated from Mexico. The plant is known as Mexican prickly poppy, Mexican poppy and prickly poppy as an annual herb grows in the dry and moist soil region of North eastern Nigeria. *A. mexicana* is a medicinal source in Ayurveda the plant parts contain different chemical compounds and secondary metabolites [6]. There is wide range of medicinal uses in all the parts of the plant, whereas leaves are used for wound healing activity, anti-pyretic, anti-inflammatory, anti-plasmodial, anti-malarial, anodyne, expectorant, hepatoprotective and diuretic activity. Roots are used as a diuretic and chronic skin disease. Seeds are used for Larvicidal activity, laxative, emetic, expectorant and demulcent [1].

Materials and Methods

Plant material

A. mexicana plant was collected from Maruda village, Gwandu local government, Kebbi State, Nigeria, and authenticated by a taxonomist Dr, Singh D. Department of Biological Sciences, Kebbi State University of Science and Technology Aliero, and was given (Voucher number of 152). The fresh leaves were separated and washed thoroughly in tap water then the leaves were shade dried for a week [7] and homogenized using mortar and pestle and stored in a glass amber bottle covered with aluminium foil paper.

Extraction

Twenty five-gram, *A. mexicana* leaves were weighed into 500 mL beaker and soaked with methanol for 72hrs with occasional sharking using a clean glass rod. The top of the conical flasks was covered with aluminium foil paper to prevent solvent evaporation and volatile constituents. The mixture was filtered through Whatman filter paper No 1, England the solvent was allowed to evaporate at ambient temperature. The extract obtained was used for the analysis [8].

Gas chromatography and mass spectroscopy

The analysis of volatile phytoconstituents of methanol extract of *A. mexicana* leaves was carried out at Ahmadu Bello University Zaria using Agilent Mass Hunter/GC-MS. Column length was 30cm with diameter of 0.00025. Helium gas was used as carrier gas with the flow rate of 1 ml/min, a sample of 3 µl was injected into injector whose temperature was maintain up to 230°C. Oven temperature was programmed at 25°C/min then increased up to 150 °c and then brought up to 230°C. The mass range was 40 - 450 m/z and temperature of MS transfer line was maintained at 200°C and source temperature was maintained at 160°C. The type of ionization used for analysis was electron ionization (EI) with electronic energy at 70ev. Scanning was done for 20 minutes, As the compounds were separated, they eluted from the column and entered a detector which was capable of creating an electronic signal whenever a compound was detected All the identified peak values of *A. mexicana* leaves extract were compared with the known compound data base stored in NIST library (Alagar, *et al.* 2015).

Results and Discussion

Peak#	Chemical name	Formula	M/W	R. Time	Area %
1	1-Cyclohexyl-1-propyne	C ₉ H ₁₄	122	5.573	1.79
2	Cyclobutanone,2-methyl-2-oxiranyl	C ₇ H ₁₀ O ₂	70	5.550	0.51
3	E-9-Tetradecenal	C ₁₄ H ₂ O	210	5.728	2.19
4	Undecanoic acid, isopropyl ester	C ₁₈ H ₅ NO ₄	329	6.689	1.60
5	Benzenamine, 2,6-dichloro	C ₆ H ₅ C ₁₂ N	161	7.044	11.22
6	bicyclo[2.2.1]heptan-2-ol	C ₇ H ₁₂ O	112	7.542	1.01
7	1-Heptyn-3-ol	C ₇ H ₁₂ O	112	7.756	0.53
8	1-Heptanol, 6-methyl	C ₈ H ₁₈ O	130	7.862	0.53
9	Carbonic acid,	C ₁₅ H ₃₀ O ₃	258	8.040	0.29
10	2-Methylenecyclohexanol	C ₇ H ₁₂ O	112	8.289	1.7
11	Arachidonic acid, TMS derivative	C ₂₃ H ₄₀ O ₂ Si	376	8.645	8.96
12	10-Undecenoic acid, TMS derivative	C ₁₄ H ₂₈ O ₂ Si	256	9.000	12.46
13	Cyclopentane, 1,3-dimethyl	C ₇ H ₁₄	98	9.356	2.96
14	Dodecanoic acid, TMS derivative	C ₁₅ H ₃₂ O ₂ Si	272	9.890	14.63
15	Palmitic Acid, TMS derivative	C ₁₉ H ₄₀ O ₂ Si	328	15.189	28.04

Table 1: Peak report TIC of *Argemone mexicana* leaves.

Chemical constituents were identified by matching mass spectra with spectra of reference compounds in mass spectral library of the National Institute of Standards and Technology (NIST 14).

GC-MS volatiles phytochemical screening of *A. mexicana* leaves extract showed total of 15 peaks as 1-Cyclohexyl-1-propyne, Cyclobutanone,2-methyl-2-oxiranyl, E-9-Tetradecenal, Undecanoic acid, isopropyl ester, Benzenamine, 2,6-dichloro, bicyclo [2.2.1] heptan-2-ol, 1-Heptyn-3-ol, 1-Heptanol, 6-methyl, Carbonic acid, but-3-en-1-yl decyl ester, 2-Methylenecyclohexanol, Arachidonic acid, TMS derivative, 10-Undecenoic acid, TMS derivative, Cyclopentane, 1,3-dimethyl, Dodecanoic acid, TMS derivative, Palmitic Acid, TMS derivative. Peak number 15 palmitic acid TMS derivative showed highest % peak area which was about 28.04% followed by peak number 14 Dodecanoic acid TMS derivative which showed 14.63 as % peak area, and peak number 9 Carbonic acid, but-3-en-1-yl decyl ester which showed the lowest % peak area as 0.29. Therefore, TMS derivative Palmitic acid is believed to be more abundance in the methanol extract of *A. mexicana* leaves as it has the tallest peak while carbonic acid showing the lowest %Peak area is believed to be the lowest in terms of availability in the methanol extract of *A. mexicana* leaves.

According to Carmo., *et al.* [9] palmitic acid was use as anti-inflammatory, antibacterial and in the production of biodiesel. Carbonic acid reduces hypertension by reducing stress calm the CNS and enhances oxygen delivery in the muscles [10]. Dodecanoic acid or lauric acid has antimicrobial properties [11]. This research concluded that the GC-MS volatile analysis of *A. mexicana* leaves shows different bioactive compounds prove for various medicinal use as confirmed by mentioned authors. This research also supports that single or combination of any of the identified compounds can be used to treat various human diseases.

Among the identified phytochemicals have the property of antioxidant and antimicrobial activities [12]. Plant based antimicrobials have enormous therapeutic potential as they can serve the purpose with lesser side effects. Continued further exploration of plant derived antimicrobials is needed today.

Conclusion

Argemone mexicana leaves having essential oil derivatives and other phyto-chemical constitutions that are useful into various herbal formulation for the treatment of several diseases such as anti-inflammatory, analgesic, antimalarial to mention but a few. These results support the possibility that, a single or mixture of the identified phyto-chemicals is responsible for the health benefit of *Argemone mexicana*.

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