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Chemical Composition of the Dichloromethane Extract of *Ephedra Alata* Leaves and Flowers

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ABSTRACT

The Composition profile of the Dichloromethane extract of the leaves and Flowers of Ephedra alata growing in Algerian desert was studied by capillary gas chromatography-mass spectrometry (GC-MS). Fifty-two Compounds of the leaves and Sixty-five Compounds of the flowers were identified. The main Compounds of the leaves are: 2-Propenoic acid, 3-phenyl ***(18.194%)****; Phenol, 4-(3-hydroxy-1- propenyl)* ***(7.881%),*** *Benzoic acid* ***(8.521%),*** *Benzaldehyde, 4-hydroxy-3,5-dimethyl* ***(7.036%);*** *Benzaldehyde, 4-hydroxy- 3-methoxy* ***(4.381%).*** *On the other hand the flowers contain some important compounds such as Benzoic acid* ***(16.874%),*** *2- Propenoic acid , 3- phenyl* ***(11.453%),*** *1,2-Benzenedicarboxylic acid, diis* ***(5.112%),*** *Benzenemethanol* ***(3.675%),*** *Benzeneethanol* ***(3.645%)****.*

Keywords: *Ephedra alata*; Dichloromethane extract; leaves; flowers ; GC-MS .

INTRODUCTION

Ephedra is the only genus in the Ephedraceae family. It comprises 50–65 species. It is widely distributed in temperate areas of Eurasia, Northern Africa, North and Southwestern America. Generally, it is often abundant in dry and open habitats such as deserts, rocky slopes, grasslands, and maritime areas with a Mediterranean climate. *Ephedra* is famous for its long history of medicinal use due particularly to the presence in many alkaloids such as ephedrine. The medical use of *Ephedra* dates back to at least 2700 B.C., when the Chinese used (*Ephedra sinica* Stapf) to treat asthma, cough, and bronchitis [1-3].

Ephedra alata is a perennial shrub, stiff, yellow-green, densely branched, 40–100 cm tall and often wider than high [4]. The *Ephedra* plant is strongly aromatic, with a bitter taste. The dried stem is the part of the shrub generally used for its therapeutic effects. It is available in bulk herb, capsules, and hydro-alcoholic extract and is often found in weight loss and energy formulas. *Ephedra* is approved for diseases of the respiratory tract with mild broncho-spasms. It is commonly used as a bronchodilator and anti-asthmatic. It has been used in traditional Chinese medicine for 5,000 years to treat allergies, bronchial asthma, chills, colds, coughs, edema, fever, flu, headaches, and nasal congestion. *Ephedra* has been used as a natural product source of many constituents including: alkaloids, tannins, saponins, proanthocyanidins, phenolic acids, flavonoids and essential oils. Plants-derived polyphenols are of great

importance for their potential antioxidant and antimicrobial properties [5-7].

MATERIALS AND METHODS

2.1. Plant material*:*

The leaves and flowers of *Ephedra alata* were collected in Mars 2011 from Ouargla outskirts, Algeria. The plant is identified by Pr. Chahma Abdelmadjid and dried under shade before being grounded.

2.2. Extraction:

100 g of the leaves and 100g of the flowers of *Ephedra alata* were macerated four times for 24 hours with 70% EtOH solution. The hydro-alcoholic solutions were concentrated under reduced pressure and the residue was dissolved in water and kept in a cold place overnight. After filtration, the aqueous solution was successively extracted with CH_2Cl_2, EtOAc and *n*-BuOH for three times for each solvent, then the extracts were concentrated. The residues obtained by CH_2Cl_2 were dissolved in Hexane and subjected to GC/MS analysis [7].

2.3. Gas Chromatography-Mass Spectrometry:

The Dichloromethane extracts were dissolved in Hexane and injected into a GC-MS apparatus (Hewlett Packard Model 5890 series) equipped with a mass selective detector (mass HP 5972). Experimental conditions for capillary GC-MS analysis were developed under the following conditions: Capillary column HP5-MS, 30 m x 0.32 mm (i.d.), detector temperature 300°C, injector temperature 280 °C.

RESULTS AND DISCUSSION

The Dichloromethane Extracts of aerial parts from *Ephedra alata* afford 52 compounds in leaves and 65 compounds in Flowers: (Table 1 and Table.2).

At first glance it appears that the main class of compounds dominating both compositions revolves around carboxylic acids which make up the major contents both in leaves and flowers. This may be attributed to the fact that dichloromethane as fairly polar solvent dissolves deliberately these acids.

Table 1: Constituents of Dichloromethane Extract of *Ephedra alata* leaves

N°	compound	T_R	Area%	Ratio %
1	Ethanol , 2-Butoxy	4.79	0.427	2.349
2	Benzaldehyde	5.44	0.478	2.629
3	Hexanoic acid	5.71	0.908	4.991
4	(methylthio) Ethane	5.89	0.787	4.328
5	Cyclopentasiloxane, decamethyl	7.31	0.225	1.234
6	Thiourea	7.45	**2.183**	11.998
7	Benzoic acid	7.83	**8.521**	41.790
8	1-Amino-Pyrrolidine	8.05	1.637	8.999
9	Thiophene, 2, 5- dihydro	8.24	0.824	4.528
10	1H -Pyrrole-2, 5-dione -3- ethyl-4- methyl	8.32	1.444	7.936
11	Nonanoic acid	8.65	0.715	3.932
12	2H-pyrrol-2-one, 1, 5-dihydro-1-methyl	8.76	0.964	5.300
13	Tetrasiloxane,decamethyl	9.18	0.440	2.416
14	Benzenemethanol	9.40	0.309	1.701
15	Benzenepropanoic acid	9.56	1.150	6.321
16	Benzaldehyde, 4-hydroxy	10.02	1.913	10.517
17	2-Propenoic acid, 3-Phenyl , methyl	10.19	2.168	11.918
18	Benzaldehyde, 4-hydroxy- 3-methoxy	10.49	**4.381**	24.076
19	2-Propenoic acid, 3-Phenyl	11.12	**18.194**	100.000
20	Benzene, (2-methoxyethyl)	11.18	0.883	4.851
21	Ethanedioic acid, (trimethyl)	11.61	0.714	3.923
22	Anhydro-Beta-D-Glucopyranose1,6	12.02	0.429	2.355
23	Heptanoic acid	12.23	1.505	8.272
24	Benzoic acid, 4-hydroxy, ethyl ester	12.33	1.171	6.437
25	-Dideuterio-4-Phenylbutylamine3,3	12.51	0.661	3.635

26	trimethyl4,4,5 -Dioxolane,1,3-	12.70	3.462	19.027
27	Benzenepropanol, 4-hydroxy	13.05	0.767	4.214
28	3-Methyl-5-Nitropyrazole	13.12	1.701	9.350
29	Benzonitrile, 4-formyl	13.46	0.628	3.449
30	1-Hydroxy-5-Methylbenzotriazole	13.63	0.328	1.803
31	Cyclohexene-l-methanol, 5-hydrox	14.32	0.343	1.886
32	Benzeneacetic acid, .alpha.-hydrox	14.55	1.428	7.849
33	Benzaldehyde, 4-hydroxy-3,5-dimethyl	14.80	**7.036**	38.673
34	Ethyl Vanillylether	14.99	1.141	6.271
35	3H-Pyrazol-3-one, 1,2-dihydro	15.17	0.545	2.993
36	Phenol, 4-(3-hydroxy-1- propenyl)	16.31	**7.881**	43.315
37	N,N-Diethyl-2-Pyridylethylamine	16.55	**3.908**	21.481
38	(-)-Loliolide	17.03	**3.667**	20.157
39	N-Methyl-2-(2-propinyl) oxybenzamid	17.85	0.863	4.744
40	Benzenemethanol, 3,4-dimethoxy	19.53	0.447	2.456
41	Hexadecanoic acid	20.27	1.211	6.654
42	-Benzenedicarboxylic acid, mono1,2	20.37	0.521	2.865
43	4a-Methyl-4,4a-dihydrophenanthren	21.10	0.693	3.806
44	Eicosenoic acid, methyl ester	23.60	0.761	4.182
45	Octadecanoic acid	24.00	0.678	3.728
46	Tricyclo(3,3,1,1(3,7))decane-2-car	24.26	0.553	3.040
47	Benzaldehyde, 4-hydroxy-3-methoxy	26.97	0.977	5.372
48	Benzenedicarboxylic acid	31.17	1.411	7.755
49	1H-Indole-3-acetonitrile, (trimethyl)	31.41	0.396	2.179
50	2-Allyl-1-methylnaphthalene	31.53	1.152	6.333
51	Propenoic acid, dimethyl	34.47	0.382	2.101
52	Benzoxathiole1,3-	40.95	**4.086**	22.455

Table 2: Constituents of Dichloromethane Extract of *Ephedra alata* Flowers

N°	**compound**	**T_R**	**Area%**	**Ratio %**
1	N^1,N^3-diethylpropane-1,3-diamine	4.64	0.291	1.723
2	2,2, 3, 3-Tetramethyl-1-D1-Aziridine	4.87	0.460	2.725
3	Ethane ,1,1, 2,2-Tetrachloro-	4.95	0.201	1.192
4	Furan, Tetrahydro-3-methyl	5.00	0.179	1.062
5	Benzaldehyde	5.53	1.132	6.706
6	Hexanoic acid	5.75	1.346	7.978
7	Pentanoic acid, ethyl esther	5.87	0.282	1.671
8	Benzenemethanol	6.34	3.675	21.782
9	Gamma-D2- Tetrahydropyran	6.50	0.523	3.102
10	Ethanone ,1- (1H-pyrrol-2-yl)	6.65	0.745	4.413
11	Butanoic acid, 3-methyl, 2-methyl	6.71	0.739	4.381
12	Octane	6.90	0.330	1.953
13	Benzeneethanol	7.21	**3.645**	21.603
14	Pentaerythritol, tetranitrate	7.55	1.103	6.538
15	Benzoic acid	7.94	**16.874**	100.000
16	1-Amino-Pyrrolidine	8.12	0.918	5.440
17	Thiophene ,2,5-dihydro	8.32	1.077	6.380
18	1, 2-Ethanediol, 1-Phenyl	8.48	1.698	10.065
19	Benzeneacetic acid, ethyl ester	8.55	0.777	4.604
20	Benzeneacetic acid	8.65	1.282	7.597
21	2-Butene, 1, 1-dimethoxy	8.76	0.709	4.202
22	Benzoic acid, phenyl ester	8.83	1.030	6.104
23	2H -Pyrrol-2-one, 1, 5-dihydro-1- methyl	8.89	0.459	2.718
24	Phenol , 5- methyl -2-(1-methylethyl)	9.43	0.314	1.859
25	Benzenemethanol	9.54	0.621	3.682
26	Benzenepropanoic acid	9.66	0.699	4.142
27	Ethyl , 3-Phenylpropionate	9.84	0.727	4.308
28	Benzaldehyde, 4-hydroxy	10.18	0.853	5.054
29	(Z) - 3-Phenyl-2- Propenoic acid	10.35	0.563	3.339

30	Benzaldehyde, 4-hydroxy- 3-methoxy	10.64	**2.044**	12.116
31	2- Propenoic acid , 3- phenyl	11.15	**11.453**	67.876
32	Guanidine, cyano	11.31	4.342	25.732
33	4-Methylcyclohexa- 2-EN -1-OL	12.04	0.727	4.311
34	Benzoic acid, 4-hydroxy, ethyl ester	12.51	0.681	4.037
35	2(4H) -Benzofuranone	12.86	1.105	6.551
36	-Dimethyl-3-(methoxymethyl)-p-benzoquinone2,6	13.17	0.391	2.318
37	Benzoic acid, 4-hydroxy- 3-methoxy	13.29	1.072	6.353
38	Hexanoic acid, ethyl esther	14.64	0.321	1.900
39	Benzeneacetic acid, 4-hydroxy- 3-methoxy	14.72	0.743	4.402
40	Benzaldehyde, 4-hydroxy-3,5-dimethyl	14.95	1.038	6.153
41	Undecanenitrile	15.19	0.710	4.208
42	phenol, 4-(3-hydroxy-1- Propenyl) - 2	16.44	**3.062**	18.148
43	Ethanol , 2-(diethylamino)- , hydroc	16.62	**2.377**	14.089
44	Nonylphenol	17.14	**2.213**	13.115
45	Phenol, 4- methoxy	17.47	0.529	3.134
46	Cyclopentane ,1,1,3,3-tetramethyl	17.96	0.727	4.311
47	Phosphine oxide , dimethyl (trifluor)	18.09	0.606	3.590
48	2-Propenoic acid, 3-(4- hydroxy- 3-methyl)	19.00	1.743	10.329
49	5-methyl-8-nitro-imidazo(1,2-A)pyrane	19.83	0.902	5.348
50	1,4-Cyclohexanedione , 2, 2, 6-trimethyl	20.12	0.384	2.275
51	N-(gamma,-L-Glutamyl)-L-proline	20.35	1.995	11.820
52	Hexadecanoic acid	20.46	0.962	5.699
53	4a-Methyl-4,4a-dihydrophenanthren	21.29	1.681	9.961
54	9- Hexadecenoic acid	23.84	3.233	19.163
55	1-Hexadecanol	24.23	0.285	1.690
56	Oxacyclotetradecane-2,11-dione	24.34	0.926	5.487
57	6-Formyl-5,7-dimethylphthalide	24.59	0.768	4.552
58	9- Octadecenamide	27.85	1.169	6.931
59	Heneicosane	28.38	0.341	2.023
60	2- Nitro-2-(3-oxobutyl)cyclooctanon	29.74	0.796	4.717
61	Thiosulfuric acid	30.13	0.633	3.753
62	1,2-Benzenedicarboxylic acid, diis	31.48	5.112	30.295
63	Heneicosane	34.58	0.436	2.585
64	Pyrimido[1,2-a]azepine	40.97	0.039	0.230
65	Benzaldehyde, 2, 4-dihydroxy	41.47	1.201	7.115

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