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PHYTOCHEMICAL VARIABILITY IN THE ESSENTIAL OIL OF *MATRICARIA PUBESCENS* FROM ALGERIA

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Matricaria pubescens is a plant belonging to the asteraceae family naturally found in Algeria, as well as throughout all of North Africa, commonly used as folk medicine to treat several diseases under several preparations, the essential oil obtained from the aerial parts of the plant contains chemical components, that were determined using GC-MS, the variability in the levels of these components was studied in nine samples collected on different dates from two sites in the northern Sahara of Algeria. 58 components were determined, with different levels, the constituents: Delta.3-Carene, Beta-Ocimene, Allo-Ocimene, (-)-Bornyl acetate, Aromadendrene 2, 4.10(14)-Muuroladien-8 beta-ol, Valencene 2 and Dihydronepetalactone II are shown to be the main chemical components of the essential oil, from the analytical obtained restults, the statistical analysis with HCA and PCA tests have revealed different chemical patterns. Aside from seasonality, chemotypes may be the most important source of variation, and the existence of several varieties featured by different chemical distribution patterns, this outcome should be confirmed by further studies with higher samples.

Keywords: *Essential Oil, Variability, Matricaria Pubescens*

INTRODUCTION

Traditional medicine or phytotherapy is commonly relied upon in Algeria, sometimes even more than modern medicine. According to statistics from the World Health Organization (WHO), nearly 2/3 of the population use phytotherapy, mainly owing to the natural availability of plants and their affordable cost. Aiming to evaluate the chemical composition as well as contributing to the development of a traditional Algerian pharmacopoeia, we were interested in studying *Matricaria pubescens* (Desf) Sch, an endemic plant; that grows naturally in arid regions and belongs to the Asteraceae family. This plant is used by local population in daily life under several forms and for several therapeutic, food and cosmetic indications. *Matricaria* comes from matrix: “female matrix” 1.

The name *Matricaria* was given by the famous botanist Linnaeus, perhaps because of its wide use as a treatment for gynecological diseases, or "diseases of the uterus (womb)"[2]. It is also known that plants with the name derived from the genus *Chamomilla* are today within the genus *Matricaria*. Various names have been suggested such as:

- *Matricaria pubescens* (Desf) Sch.Bip
- Hairy camomille[3].
- *Aaronsohnia pubescens* (Desf)[4].
- *Cotula pubescens* Desf 1799[5].
- *Chamomilla pubescens* (Desf) Alavi[56].
- *Chlamydophora pubescens* (Desf) Coss & Durieu[7].
- *Chrysanthemum corymbosumvar pumila* Batt & Jahand.
- *Chrysanthemum cossonianum* Batt.[8]

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- *Matricaria pubescens* subsp.pubescens (Desf.) Sch.Bip[7].
- *Otoglyphis pubescens* (Desf) Pomel[9,10].
- In Arabic culture: Ouazouaza or Guertoufa were assaigned to *Matricaria* [3,11].

Botanically, they are described as rustic, aromatic pleasant smelling species, growing along roadsides in rural areas. Although sometimes are considered as pests, they are suitable for rock and herb gardens, as well as edging plants. Their multi-branched stems are prostrate, erect, glabrous and very leafy, the leaves are bipinnate; have many linear, tightly lobed leaflets[12,13].The flowers are radially symmetrical, greenish-yellow in color with semi-spherical heads[14]. White rays may be present (*M. recutita*) or no (*M. discoidea*). The disc florets are toothed with 4 to 5 lobes[15]. The receptacle is 2-3 times taller than its width, with pappus that may be in the form of a short crown **(Fig. 1)**[16]. Two classifications have been suggested for *Matricaria pubescens*, namely Cronquist and APG[17].

Fig.1: Photo of Matricaria *pubescens.*

Regarding the geographical distribution, *Matricaria* is endemic to North Africa, in Algeria, the plant is common throughout the northern Sahara corresponding to the regions of: Biskra, Figuig, El oued, Touggourt, Colomb-Béchar, Ghardaia, El golea, Ouargla, Beni Abbès, and in the central Sahara which includes the regions of: Adrar, Tamanrasset, Djanet, Fort-polignac, Fort-flatters, Timimoun, In-salah[18]. Some of the plant popular therapeutic uses are summarized in the **Table1**. Coumarines are among the principal constituents mainly in the aerial parts of *Matricaria pubescens*[25], as Herniarin, Dihydroherniarin, (2E, 4E) -6- (2-thienyl) -2,4-hexadiene-isobutylamide.

Besides, several flavonoids have been isolated from the aerial part: Apigenin, Luteoline, Quercetin, Apigenin 7-*O*- β-D –glucoside, Luteoline 7- *O* - β-D –glucoside, Quercetin 3-*O*- β-D –Glucoside, Isorhamnetine 3- *O* - β-D –glucoside, Isovitexine, 4`- *O* - Methylisoscutellareine-7- *O* - [6 " '- *O* -acetyl-β-D-glucosyl- (1 → 2) -β -D- glucoside], Isoscutellareine-7- *O* - [6 " '- *O* -acetyl-β-D-glucosyl- (1 → 2) -β-D-glucoside], 4`- *O* - Methylisoscutellareine-7- *O* - [β-D-glucosyl- (1 → 2) -β-D-glucoside].

Essential oil of *Matricaria pubscens* from Ghardaia (Algeria) has been characterized by GC-MS.

The results noted tha *Matricaria pubescens* mainly contains: Isochrysanthemic acid ester of ethyl (26.5%), spathulenol (19.4%), α-cadinol (12.9%) geranyl isovalerate (8.2%), Z-Nerolidolepoxyacetate (4.5%) and Ledol (3.5 %)[26].

Accordingly, the objective of the current study is to contribute to the qualitative and quantitative study of the main secondary metabolites in the essential oil of *Matricaria pubescens* samples collected from two sites, and to study the variability of the chemical composition during vegetative cycle. This endeavour will be carried out by the use of Gas chromatography coupled to mass spectrometry (GC-MS).

Table 1: Traditional uses of *Matricaria pubescens*(Desf) Sch.Bip [19].

Diseases	Preparations	Use
Rheumatism [20,21,22]	A decoction of handful of flower heads, and leaves, prepared in a teapot.	A glass for morning and evening.
Skin rash [19]	No preparation	Rubbing the swollen part of the skin or gum with a flower head
Dermatosis [23]	Decoction	Indicated as a body bath.
Dysmenorrhea [24]	Matricaria, cloves, *Ruta tuberculata*, *cinnamon and Zygophyllum* are dried then pulverized and mixed in equal parts; the mixture is used to prepare a decoction with water.	A glass of of the decoction in the first day of menstruation during three consecutive cycles.
Asthma [19]	Decocted with the addition of local butter	Oral intake is recommended.
Immune disease (allergy)[19]	Decoction or infusion	Oral intake
Fever or sting Scorpio [23]	*Matricaria* flower heads are boiled in water or milk	Oral intake
Eye infection [24]	The flower heads are soaked in hot water then crushed.	The liquid used as an instillation.

MATERIALS AND METHOD

Plant material

Aerial parts and the flowers of the plant were sampled from the month of Nov 2015 to May 2016 from two sites in the southern east of Algeria namely: Biskra and Ouargla. The samples from 1 to 5 were taken from the site Biskra, harvested respectively in Nov 2015, Jan, Feb, Mar, Apr 2016, whereas the samples from 6 to 9 constitute the samples harvested from Ouargla in Jan, Feb, Mar, Apr 2016.

Reagents

Distilled water used for extraction and Cleaning obtained from the laboratory of toxicology, university hospital of Batna.

Ethanol used for dilution of essential oil, Sigma Aldrich SZBC2860V.

Glassware

Volumetric flasks, Erlenmeyers (50 and 100mL), flasks, crucible funnel, Buchner flask, Amber glass vials, micropipettes, ground-neck flask 29/32, Crystallizer

Laboratory equipments

Analytical balance, Sartorius

Apparatus for the determination of essential oils, DAB method, in borosilicate glass, Witeg 29/32. GC-MS, Perkin Elmer (CLARUS 500 GC and CLARUS 600 D MS) monitored by Turbomass software.

Statistical test

The statistics and data analysis were conducted with R language using R studio software, the packages: pca3d, ggplot2, hclust have been used to conduct principal components analysis and hierarchical clustering, the coefficients of correlation between the levels of components were calculated using Microsoft EXCEL 2010. The normality of data is assessed using Kolmogorov-Smirnov test, the *p* value ranged from 0.23 to 0.4, indicating that the data of the study does not differ significantly from that which is normally distributed.

Extraction and dosage of essential oils

The essential oils are extracted by hydrodistillation from the aerial parts of the *Matricaria pubescens* for 3 continuing hours using an extraction apparatus standardized by the European Pharmacopoeia. The operation was repeated several times for each sample. The essential oil yield is determined in mL / Kg of the dried vegetal material. The gotten essential oil was at that point put away at 4 ° C secured from light.

Experimental protocol for the analysis of essential oil by GC –MS

The chromatographic analysis of the essential oil was carried out by gas chromatography coupled with a mass spectrometer of the Clarus 600 D MS type (Perkin Elmer USA). The injections were performed in splitless mode using a RESTEK Rtx® -5MS capillary column with a length of 30 meters, an internal diameter of 0.25 mm, and a film thickness of 0.25 m. At a flow rate of 1mL/min, helium was used as a carrier gas. The injector and transfer line were both heated to 250 degrees Celsius. The initial temperature was set at 60 ° C and held for 1 minute, then increased by 3°C / min to 200°C and kept isothermal for 13 minutes. The acquisition is done in Scan mode with electron ionization (EI) at 70 eV. (From 40 to 600). The mass spectra of the compounds were compared to those provided by the WILEY and NIST libraries to identify them. The essential oils were diluted to a concentration of 1 g/L in ethanol. The internal standardization method determines the percentage contents of essential oils components.

RESULTS AND DISCUSSION

Results

Results of the qualitative and quantitative analysis of the essential oils by GC-MS

The average extraction yield expressed in mL/Kg is 1.91 ± 0.9. While that, the average essential oil yield obtained from the samples of *Matricaria pubescens* collected from Biskra is showed to be higher than that of Ouargla **(Table2)**. Furthermore, the average essential oil yield of *Matricaria pubescens* obtained in the present study is lower than those recorded in similar studies[28&29]. The investigation of essential oils by GC-MS allowed the identification of 58 chemical components, besides, the density of *Matricaria pubescens* essential oil was found to be around 0.83 g/mL.

The chemical composition of the different essential oils from the collected samples is presented in the **Table 3**. The main constituents of *Matricaria pubescens* from Biskra are: Delta.3-Carene, Beta-Ocimene, Allo-Ocimene, dihydropentalactone II, regarding the samples from Ouargla, two further components: Bornyl acetate and Aromadendrene are present.

Table2: The extraction yields in essential oils of the harvested samples.

Samples of Biskra	Extraction yield mL/kg	Samples of Ouargla	Extraction yield mL/kg
1	3	**6**	1.8
2	1	**7**	0.5
3	3.2	**8**	1.75
4	1.35	**9**	2
5	2.6		
Average yield	2.23 ±0.99		1.51 ± 0.68
Global Average yield	1.91 ± 0.9		

Table3: The chemical composition of the 9 samples' essential oil of *Matricaria pubescens*) expressed in percentage (%), with classification, molecular weight (MW) in g/mol and retention time (RT) in minutes.

Compound	classification	MW	RT	1	2	3	4	5	6	7	8	9
Delta.3-Carene	Bicyclic monoterpene	136.23	6.34	28.58	12.36	14.55	20.2	2.32	12.99	27.42	12.36	8.99
Camphene	Bicyclic monoterpene	136.23	6.85	0	0	0	0	0	0.06	0	0	0
Sabinene	Bicyclic monoterpene	136.23	7.46	0.08	0.06	0.07	0.06	0.22	0.1	1.04	0.06	0.27

Table 3: Continued.

2-.Beta.-Pinene	Bicyclic monoterpene	136.23	7.58	0	0	0.03	0	0.06	0.06	0.19	0	0.05
Beta.-Myrcene	Acyclic monoterpene	136.23	7.95	0.1	0.15	0.14	0.09	0.34	0.18	0.23	0.09	0.04
Alpha-Phellandrene	Monocyclic monoterpene	136.23	8.42	0.01	0	0.03	0	0.04	0.06	0	0	0
Alpha.-Terpinene	Monocyclic monoterpene	136.23	8.93	0	0	0	0	0.02	0	0.07	0	0.14
Delta-Limonene	Monocyclic monoterpene	136.23	9.24	0.39	0.15	1.89	1.76	2.94	1.7	1.93	1.19	1.18
Beta-Ocimene	Acyclic monoterpene	136.23	9.61	61.53	71.41	67.53	65.88	66.28	67.09	45.84	36.18	19.67
Rothrockene	Monocyclic monoterpene	136.23	9.91	0.95	1.29	1.62	2.73	3.2	1.87	1.2	0.47	0.29
Gamma.-Terpinene	Monocyclic monoterpene	136.23	10.4	0	0	0	0	0.04	0.02	0.13	0.03	0.46
(+-)-Trans-1-(1-Methylethenyl)-2-(2-methyl-1-propenyl)-cyclopropane	Monocyclic monoterpene	136.23	10.7	0	0	0	0	0	0	0	0.01	0.02
Nerol	Acyclic monoterpene alcohol	154.24	11.04	0	0	0	0	0	0	0	0.09	0.2
(1S.5R)-2.5-Dimethylbicyclo[3.2.0]hept-2-ene	Bicyclic monoterpene	134	11.34	0	0.01	0.1	0.03	0	0	0	0.01	0
Alpha.-Humulene	Monocyclic sesquiterpene	254.35	11.43	0	0	0.05	0	0.12	0.06	0.05	0.01	0.13
3-Methyl-2-(3'-methyl-2'-butenyl)furan	Monocyclic monoterpene	150.22	11.76	0	0	0.01	0	0.09	0.07	0	0.14	0.41
Cis-Farnesol	Acyclic sesquiterpene	222.37	11.89	0.02	0	0.02	0	0.1	0.02	0.09	0.03	0.14
Trans-Caryophyllene	Bicyclic sesquiterpene	204.35	12.6	0	0.72	0.03	0.27	0.06	0	0	0.05	0.04
Gamma.-Terpinene	Monocyclic monoterpene	136.23	12.77	0.06	0	0	0.18	0.39	0	0	0.02	0.08
Beta-Phellandrene	Monocyclic monoterpene	136.23	12.81	0	0.07	0.11	0	0.19	0.3	0	0	0.03
Allo-Ocimene	Acyclic monoterpene	136.23	13.03	3.64	5.94	10.19	5.14	8.57	5.89	3.98	2.73	1.92
1.4-Cyclohexadiene. 1-methyl-4-(1-methylethyl)	Monocyclic monoterpene	136	13.5	0.02	0.03	0.08	0.09	0.19	0.21	0	0	0.11
3-Ethoxy-1-p-menthen-8-ol	Monocyclic monoterpene	198.30	14.66	0	0.02	0	0	0.11	0	0.04	0.05	0.1
1(7).5.8-o-Menthatriene	Monocyclic monoterpene	136.23	16.06	0	0.06	0	0.01	0.17	0.03	0.1	0.11	0.08
Lauraldehyde	Acyclic monoterpene	184	16.22	0	0	0	0	0	0	0	0	0.03
1(7).4.8-o-Menthatriene	Monocyclic monoterpene	136.23	16.38	0	0.26	0	0.1	0.31	0.16	0.23	0.18	0.16
1(7).3.8-o-Menthatriene	Monocyclic monoterpene	136.23	19.23	0	0.19	0	0	0	0	0	0	0

Table 3: Continued.

(-)-Bornylacetate	Bicyclic monterpene ester		19.65	0.16	0.15	0.25	0.08	0.4	0.53	8.11	21.93	0.91
Sabinylacetate	Bicyclic monterpene ester	194.27	21.32	0.04	0	0	0	0.15	0	0	0	0
1-Methyl-2-(1'-methylethenyl)-3'-ethenylcyclopropylmethanol	Monocyclic monterpene	152	23.43	0	0	0	0	0.05	0.02	0	0	0
1.4-Cyclononadiene	Monocyclic monterpene	122	23.83	0	0	0	0	0.03	0	0	0.01	0
1-Allyl-7-methyltricyclo[4.1.0.0(2.7)]heptane	Tricyclic monoterpene	148	23.99	0	0	0	0	0.03	0	0	0	0
1-Cyclopropyl-3.4-dimethyloxyeugenol	Monocyclic sesquiterpene	266	24.63	0	0	0.04	0.02	0.09	0.04	0.25	0.01	3.18
Cis-Caryophyllene	Bicyclic sesquiterpene	204.35	25.2	0.9	0.75	0.67	1.08	3.09	1.53	2.6	1.61	3.66
Oxiranecarboxylicacid. 3-phenyl-. Ethyl	Aromatic compound	206.23	26.11	0	0	0	0	0.06	0	0	0	0
(+-)-Trans-1-(1-Methylethenyl)-2-(2-methyl-1-propenyl)-cyclopropane	Monocyclic monterpene	136.23	26.57	0	0	0.03	0.02	0.22	0	0.16	0.07	0.31
Germacrene-D	Monocyclic sesquiterpene	204.35	27.68	0.77	1.01	0.58	0.43	1.45	0.95	1.11	0.63	0.16
Aromadendrene 2	Tricyclic sesquiterpene	220.35	28.3	0.24	0	0.26	0	0.36	1.57	2.24	19.39	3.2
Trans-.Gamma.-Bisabolene	Monocyclic sesquiterpene	204.35	29.05	0.11	0.17	0.17	0.02	0.57	0.32	0	0	0
(-)-A-copaene	Tricyclic sesquiterpene	204.35	29.39	0	0	0	0	0.05	0	0.01	0	0
(Z.Z)-.Alpha.-Farnesene	Acyclic sesquiterpene	204.35	30.5	0	0	0	0	0	0	0	0	0.22
1(7).5.8-o-Menthatriene	Monocyclic monoterpene	134.22	30.76	0	0	0	0	0	0	0	0	0.46
Nerolidol	Acyclic sesquiterpene	222.37	30.98	0	0	0	0	0	0	0	0	0.17
Dispiro[cyclopropane-1.6':2.6"-bis(exo-6-bicyclo[3.1.1]heptane)]	Bicyclic sesquiterpene	220.35	31.45	0	0.1	0	0.03	0.61	0	0	0.26	0
4.10(14)-Muuroladien-8.beta.-ol	Bicyclic sesquiterpene	204.35	31.57	0	0	0	0	0	0	0	0	7.93

Table 3: Continued.

Valencene 2	Acyclic monoterpene edter	196.29	31.7	0	0	0	0	0.55	0	0.3	0.49	8.29
NerylAcetate	Tricyclic sesquiterpene	204.35	32.68	0	0	0	0	0.2	0.13	1.1	0.21	4.99
(+)-Aromadendrene	Monocyclic sesquiterpene	204.35	33	0	0	0	0	0	0	0.06	0	0
1.6-Cyclodecadiene.1-methyl-5-methylene-8-(1-methylethyl)-.[s-(E.E)]	Aromatic compound	208.25	33.79	0.11	0.15	0	0.16	0.69	0.13	0.07	0	0
Cis-Asarone	Bicyclic sesquiteroen	204.35	34.21	0.18	0.23	0.23	0.47	0.66	0.51	0.09	0.35	0
Trans-.Alpha.-Bergamotene	Aromatic compound	176.17	35.37	0	0.05	0.02	0	0.17	0.04	0.43	0.22	6.41
Herniarin	Acyclic monoterpene	211	36.7	0	0	0	0	0	0	0.05	0.09	0.68
1.1-Dimethylethyl 5-methyl-3-oxo-2-methylenehexanoate	Lactonic monoterpene	168.23	37.39	0	0	0	0	0	0	0.02	0	0.19
Dihydronepetalactone II	Aromatic compound	198.22	41.07	2.1	3.27	0.99	1.09	4.62	2.71	0.04	0	19.56
Capillarine	Lactonic sesquiterpene		42.27	0	0	0	0	0.02	0	0	0	0.44
Gamma.-cis-sesquicycloger aniol	Acyclic monoterpene ester	212.33	46.87	0	0	0	0	0.07	0	0.01	0	1.11
Citronellylpropionate	Acyclic sesquitepen	254.37	49.52	0	0.58	0.1	0.35	0	0	0	0	0
8-Pivaloyloxygeraniol	Bicyclic monoterpene	136.23	49.86	0	0	0.01	0	0	0	0	0	0

Discussion

Variability in the composition of the essential oils

Regarding the chemical contents of the essential oils from the samples of Biskra, high levels of Beta-Ocimene are noted ranging from 61.53 to 71.41%. The variability of the levels of Delta.3-Carene is on the other hand, going from 2.32% to 28.58% reaching a highest level in the month of fruiting (April). For Allo-Ocimene, the highest levels are recorded in February and April. Whereas that, the level of Dihydropentalactone II reaches its maximum in the month of fruiting (4.62%).

Regarding the samples from Ouargla, the maximum level of Delta.3-Carene is recorded in February and the minimum in April 27.42 and 8.99% respectively. Besides, the levels of Beta-Ocimene and Allo-Ocimene vary in the same direction from January to April ranging from 67.09 to 19.67% and from 5.89 to 1.92% respectively. While that, Bornyl acetate and Aromadendrene reach maximum values of 21.93% and 19.32% respectively in March.

Similar to the samples of Biskra, the level of Dihydropentalactone II from the samples of Ouargla reaches its maximum in the month of fruiting (19.56%). A parallel study showed that the essential oil of *Matricaria pubescens* mainly contains Beta-Ocimene (53.8%), Myrcene (15.2%) and α-Pinene (7.7%)[26].

Furthermore, samples of Matricaria collected from a site in Ghardaia (the south of Algeria) showed a different chemical composition comparing to the current study, the major compounds reported were: Ethyl ester Isochrysanthemic acid (26.5%), Spathulenol (19.4%), Alpha-cadinol (12.9%) and Geranylisovalerate (8.2%)[27].

The evaluation of the chemical variability among the *Matricaria pubescens* samples from the above mentioned sites was made by conducting multivariate analysis, PCA (Principal Component Analysis) and HCA (Hierarchical Cluster Analysis) on the primary main constituents, indeed, Delta.3-Carene, Beta-Ocimene, Allo-Ocimene, (-)-Bornyl acetate, Aromadendrene 2, 4.10(14)-Muuroladien-8.beta.-ol, Valencene 2, Dihydronepetalactone II have been retained, since they all have levels superior to 5%, and they constitute the salients compounds in the essential oil from the harvested samples.

Two principal compounds have been kept, accounting for 82% of the data variance, The PCA, and HCA (Euclidian distance**) (Fig.s 2, 3)** analysis show a cluster that groups the samples from 1 to 7, while that, the samples 8 and 9 seem to be outliers. The study of correlation between the factors has shown high correlation coefficients between the levels of Beta-Ocimene and Allo-Ocimene (0.73), Bornyl acetate, Aromadendrene2 (0.95), 2,4.10(14)-Muuroladien-8.beta.-ol, Valencene2 and Dihydronepetalactone II (0.99, 0.96 and 0.96 respectively), while high negative correlation levels between Beta-Ocimene levels and 4.10(14) –Muuroladien -8.beta. -ol, Valencene 2, Dihydronepetalactone II (-0.75, -0.78 and -0.66) respectively.

It is noted that, the samples from 1 to 7 share the same pattern as regard to the distribution of the compounds' levels with high levels of Beta-Ocimene, and low levels of Bornyl acetate, Aromadendrene2, 4.10(14)-Muuroladien-8.beta.-ol, Valencene2, Dihydronepetalactone II, on the other hand, the samples 8 and 9 are characterized by low levels of Beta-Ocimene, high levels of Bornyl acetate and Aromadendrene2 for the sample 8, while that the sample 9 contains highest levels of 4.10(14)-Muuroladien-8.beta.-ol, Valencene 2 and Dihydronepetalactone II, contrasting all the other samples.

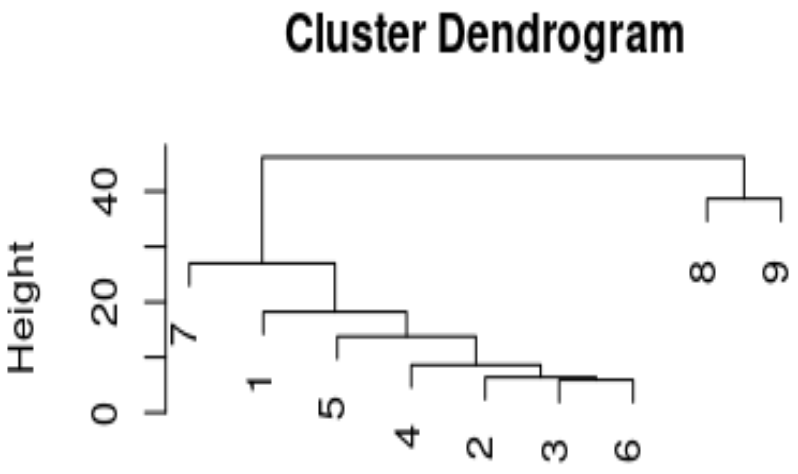

Fig. 2: Dendrogram of the chemical variability in the essential oils from the harvested samples.

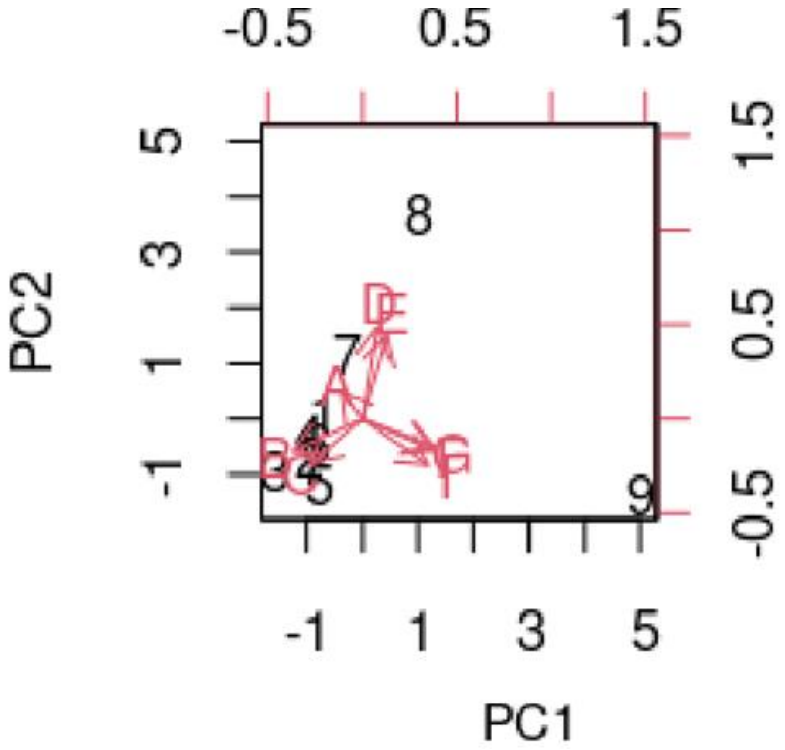

Fig. 3: Biplot of the PCA analysis of the essential oil samples (A: Delta.3-Carene, B: Beta-Ocimene, C: Allo-Ocimene, D: Bornyl acetate, E: Aromadendrene 2, F: 4,10(14)-Muuroladien-8.beta.-ol, G: Valencene2, I: dihydronepetalactone II).

It is noteworthy to mention that the variability due to seasonality is insignificant,

Insofar as the 7 first samples, which are all grouped in the same cluster (with low Euclidian distances between them), have been harvested distinctly from the month of November to April, however, this statement does not in any way suggest a complete similarity in the levels of the compounds.

In order to explain the chemical variability, weather data records **(Table4)** from the two sites were studied and their comparison seems to be without significant difference, leading to ascribe the noted chemical variability probably to chemotype varieties, this hypothesis could be underpinned while collating the data of the current study with that of Boutaghane[27] (from the site : Gherdaia), in fact, the existence of several different varieties with different chemical patterns may be put forward, the unavailability of similar studies has not permited the confrontation of the results of the present study and their comparision. Therefore, for a full explanation an in-depth study with higher sampling and broader geographic coverage would be primordial.

Matricaria pubescens is an endemic plant, specific to north Africa, employed by the local population in several therapeutic, cosmetic, and culinary uses, The endeavor was interested in determining the chemical components and evaluating the variability of nine collected samples of Matriacria' essential oils from November to May coming from two separate sites: Biskra and Ouargla, where extraction of the essential oil was carried out. followed by a chromatographic analysis and the determination of the compounds, the seasonality induced some difference although insignificant in the levels of the chemical constituents between the essential oil samples, on the other hand, the multivariate analysis generated a cluster that groups the seven first samples (five samples from Biskra and two from Ouargla) harvested in distinct months and featured by high levels of Beta-Ocimene, and low levels of Bornyl acetate, Aromadendrene2, 4.10(14)- Muuroladien-8.beta.-ol,Valencene2, Dihydronepetalactone II, and on the other hand the samples 8 and 9 harvested from the site Ouargla showing different chemical patterns, having both less levels of Beta-Ocimene, and high levels of Bornyl acetate and

Aromadendrene2 for the sample 8, meanwhile that the sample 9 contains highest levels of 4.10(14)-Muuroladien-8.beta.-ol, Valencene 2 and Dihydronepetalactone II. The existence of several chemotypes varieties could be the reason behind the above mentioned variability, the current study would open the gates to further studies with larger sampling and wider harvesting areas to give full understanding of the issue.

Table 4: Weather data of the two sampling sites.

Month	Average temperature (°C)		Min temperature (°C)		Max temperature (°C)		Rainfall (mm)	
Site	Biskra	Ouargla	Biskra	Ouargla	Biskra	Ouargla	Biskra	Ouargla
January	11.1	10.2	5.8	3.6	16.4	16.8	12	10
Febuary	12.9	12.6	7.6	5.8	18.3	19.4	8	5
March	16.4	16.2	10.2	9.1	22.7	23.4	13	8
April	20.4	20.6	13.8	13.1	27.1	28.2	10	5
May	25.5	25.3	18.5	17.7	32.6	32.9	12	5
Juin	30.5	30.3	23.7	22.9	37.4	37.8	5	2
July	33.8	33.4	26.7	25.1	40.9	41.7	1	0
August	33	32.4	26.3	24.3	39.8	40.6	4	1
September	28.3	28.8	22.3	21.4	34.4	36.2	16	4
October	22.3	22.1	16.4	15.3	28.2	29	16	6
November	16.1	15.7	10.9	9.2	21.4	22.2	17	9
December	12	10.8	6.9	4.6	17.1	17.1	10	10

Author contributions

Study conception and design (Mohammed tahar Benmoussa, Youcef Hadef); Acquisition of data (Mohammed tahar Benmoussa, Said Nadji); Analysis and interpretation of data (Said Nadji, Mohammed tahar Benmoussa); Provision of reagents/resources (Mohammed tahar Benmoussa, Soumaya Boudjemaa); Drafting of manuscript (Said Nadji, Mohammed tahar Benmoussa).

REFERENCES

1. L.Ballerini, "A Feast of Weeds: A Literary Guide to Foraging and Cooking Wild Edible Plants", ***Univ of California Press,*** (2012).
2. S. Sams-Dodd, "Drug discovery: selecting the optimal approach", ***"Drug Discov Today,*** 11(9-10),465-472 (2006).
3. N. Harborne, J. Christophe Jacquier and D. O'Riordan, "Optimisation of the extraction and processing conditions of camomille (Matricaria chamomilla L.) for incorporation into a beverage", ***J of Food Chem,*** (115):15-19 (2009).
4. B. Müller-Jakic, W. Breu, A. Pröbstle, K. Redl, H. Greger and R. Bauer, "In vitro inhibition of cyclooxygenase and 5-lipoxygenase by alkamides from Echinacea and Achillea species", ***Planta Med,*** 60(01), 37-40(1994).
5. G.Volpato, P. Kourková and V. Zelený, "Healing war wounds and perfuming exile: The use of vegetal, animal, and mineral products for perfumes, cosmetics, and skin healing among Sahrawi refugees of Western Sahara", ***J Ethnobiol Ethnomedicine***, 8, 49 (2012).
6. N.Agiel and F.A.Mericli, "Survey on the Aromatic Plants of Libya", ***Indian J Pharm Educ Res,*** 51(3), S304-S8 (2017).
7. R.Vogt and C. Oberprieler, "Chromosome numbers of North African phanerogams. VIII. More counts in Compositae", ***Willdenowia,*** 38(2), 497-519 (2008)
8. E.Battaglia, "Cytogenetics of B-chromosomes", ***Caryologia***, 17(1), 245-299(1964).
9. L. Souag, "Explaining Korandjé: Language contact, plantations, and the trans-Saharan trade", ***JPCL***, 30(2),189-224 (2015).
10. A. Benaradj, M. Bouazza and H. Boucherit, "Ecology of the Pistacia

atlantica group in the Oran Saharan atlas (Bechar-Algérie)", ***Bot Sci,*** 25, 87-94(2015).
11. K. Maiza, A. Longeon, V. Hammiche and M. Guyot, "Biological activities of plants collected in the Algerian Sahara", ***Life Sci Leafl***, 52-56(2014).
12. V. Hammiche and K. Maiza, "Traditional medicine in Central Sahara: pharmacopoeia of Tassili N'ajjer", ***J Ethnopharmacol,*** 105(3), 358-367 (2006)
13. K. Maiza, V. Hammiche and R. Brac de la Perrière, "Traditional saharian pharmacopoeia. WOCMAP I-Medi and Arom Plants Conf: part 2 of 4(1992).
14. K. Maiza, V. Hammiche and F. Maiza-benabdesselam, "Traditional medicine in north Sahara: the "Deffi"", ***Life Sci Leafl***, 16, 551-560 (2011).
15. A. Amssayef and M. Eddouks, "Aqueous Extract of *Matricaria pubescens* Exhibits Antihypertensive Activity in L-NAME-induced Hypertensive Rats through its Vasorelaxant Effect", ***Cardiovasc Hematol Agents Med Chem,*** 17(2), 135-143 (2019).
16. F. Ramdane, M.H.Mahammed, M.D.O. Hadj, A. Chanai, R.Hammoudi and N. Hillali, "Ethnobotanical study of some medicinal plants from Hoggar, Algeria", ***J Med Plant Res,*** 9 (30), 820-827(2015).
17. M. Hammouda, S.I.Ismail, N.S.Abdel-Azim and K.A. Shams, "A guide to medicinal plants in North Africa, IUCN Center for Mediterranean Cooperation, Malaga, 2005.
18. P. Ozenda, "Flora and vegetation of the Sahara: CNRS", ***Paris,*** (1991).
19. K. Maiza, R. Brac de la Perrière and V. Hammiche, "Traditional Saharan pharmacopoeia: North Sahara, (1996).
20. F. Abdoun and N. Sadki, "Gartoufa and Wazwaza: two Saharan herbs between systematic confusion and medicinal interest", ***ASJP***, 8(1), 8-12 (2017).
21. M.K.Boukef, "Plants in traditional Tunisian medicine. Traditional medicine and pharmacopoeia", ***Librairie Larose, Paris,*** 350, (1986).
22. M.O.El Hadj, M. Hadj-Mahammed, H.Zabeirou and A. Chehma, "Importance of spontaneous medicinal plants in the traditional pharmacopoeia of the Ouargla region (Northern Sahara-Eastern Algeria", ***S&T C,*** (20), 73-78(2003).
23. W. Lakhdari, A. Dehliz, F. Acheuk, R. Mlik, H. Hammi and B. Doumandji-mitiche, "Ethnobotanical study of some plants used in traditional medicine in the region of Oued Righ (Algerian Sahara)", ***J Med Plants Stud,*** 4(2), 204-211(2016).
24. V. Hammiche and K. Maiza, "Traditional medicine in Central Sahara: pharmacopoeia of Tassili N'ajjer", ***J Ethnopharmacol,*** 105(3), 358-367 (2006).
25. N. Benkiki, Z. Kabouche and C. Bruneau, "Two coumarins and a thienylbutylamide from Anacyclus cyrtolepioides from the Algerian Septentrional Sahara", ***Chem Nat Compd,*** (43),612–613 (2007).
26. H.M. Bouziane, D. Amirate and N. Salah, "Analyse qualitative par GC-FID de l'huile essentielle de la plante Matricaria *pubescens* et evaluation de son action biologique", ***Universite Kasdi Merbah – Ouargla,*** (2011).
27. N. Boutaghane, A. Kabouche, R. Touzani, Y.A. Maklad, A. El-Azzouny and C. Bruneau, "GC/MS analysis and analgesic effect of the essential oil of Matricaria *pubescens* from Algeria", ***Nat Prod Commun,*** 6(2), 251-252 (2011).
28. A. Dehimat, "Antimicrobial activity of essential oils of Matricaria pubescens: University A.MIRA-BEJAIA(2014).
29. B. Mebarka, "Extraction and analysis of the chemical composition of Saharan plants of medicinal interest", ***University Kasdi Merbah – Ouargla,*** (2015).

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الاختلاف الكيميائي النباتي للزيت العطري نبات ماتريكاريا بوبيسنس من الجزائر

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ماتريكاريا بوبيسنس هونبات ينتمي إلى عائلة المركبات ينمو بشكل طبيعي في شـــمال أفريقيـــا ويستعمل في الطب الشعبي لعلاج العديد من الأمراض تحت عده مستحضرات يحتوي الزيت العطـــري المستخرج من الأجزاء العلوية من النبات على مركبات كيميائية. الهدف من هذه الدراسة هو التعـــرف على المكونات الكيميائية باستخدام الكروماتوغرافيا الغازية مقرونة بمقياس الطيف الكتلي كمـــا تمـــت دراسة التباين في مستويات هذه المركبات الكيميائية في ٩ عينات جمعت في تواريخ مختلفة من موقعين في الصحراء الجزائرية تم تحديد ٥٨ مكونا كيميائيا بمستويات مختلفة وفقا للعينة.

قد ثبت أن المكونات الرئيسية هي Beta. Ocimene Delta.3-Carene Alloocimene (-)-Bornyl acetate (-)-Bornyl acetate dihydronepetalactone II valencene 24,10(14)-Muuroladien-8.beta.-ol

أظهر التحليل الإحصائي باستخدام اختبارات HCA وPCA أنماط كيميائية مختلفة بصرف النظر عن الموسمية. قد تكون الأنماط الكيميائية أهم مصدر للتباين ويجب تأكيد هذه النتائج خلال مزيد مـــن الدراسات و المزيد من العينات.