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Research Article

Essential Oil Composition of *Pulicaria undulata* (L.) DC. (Asteraceae) Growing in Algeria

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ABSTRACT
The essential oil obtained by steam distillation of aerial parts of *Pulicaria undulata* (Asteraceae) was analyzed by GC and GC/MS. 31 compounds were determined among which oxygenated terpenoids represented 74.3% while the non oxygenated fraction represented 22.7%. The major components were carvotanacetone (14.8%), δ-cadinene (8.2%), α-cadinol (4.7%) and thujanol (4.7%). These results differ from the few previous studies reported on this species.

Keywords: *Pulicaria undulata*, Asteraceae, essential oil, carvotanacetone.

INTRODUCTION

The genus *Pulicaria* belonging to the Asteraceae family, is represented by 80 species distributed in Europe, North Africa and Asia[1]. In Algeria, the genus *Pulicaria* is represented by 16 species from which four are located in the Sahara[2,3]. *Pulicaria* species have been used in folk medicine as insect repellents, galactagogues, antiepileptics, andtonics[4], as well as for the treatment of colds, cough, colic, excessive sweating and as carminative[5]. Chemical investigation of the genus *Pulicaria*, revealed essentially the presence of sesquiterpene lactones[6,7], flavonoids[1,8,9] and caryophyllene derivatives[10-12]. *Pulicaria undulata* (L.) DC. (Asteraceae) is one of the valuable medicinal plants used in folk medicine. It is used in the central Sahara to treat chills, diabetes, cardiac disorders, skin diseases and abscesses[13]. In Egypt, it is used to treat inflammation, as insect repellent and as herbal tea[14]. The composition of the essential oil of *P. undulate* from different countries has been reported to contain carvotanacetone as major component. For example, essential oil from Yemen and Sudan, showed high concentration of carvotanacetone (91.4 and 55.0% respectively)[15,16]. The oil showed antibacterial[17], sedative[18] and insecticidal activities[19]. In continuation of our studies on *Pulicaria* species[20-22], we report herein, our results concerning the chemical composition of the essential oil of the aerial parts of *Pulicaria undulata*(L.) DC. collected in the Southwest Algerian Sahara which was different from those reported previously on this species.

MATERIALS AND METHODS

Plant materiel

The aerial parts of *Pulicaria undulata* were collected on April 2011 from the area of Djanet (Tassili) wilaya of Illizi in Algerian Sahara and authenticated by professor Gérard De Bélair, Badji Mokhtar University, Annaba, Algeria, according to Quezel and Santa (1963). A voucher specimen has been deposited in the Herbarium of the VARENBIOMOL research unit, University Frères Mentouri Constantine.

Extraction of the essential oil

The aerial parts (200g) of *Pulicaria undulata* were subjected to steam distillation in a Kaiser Lang apparatus for three hours. The obtained essential oil was collected and dried over anhydrous sodium sulfate and kept at 4°C until analysis. The yield of the oil was calculated in relation of the dry weight of the plant.

GC and GC-MS analysis

The essential oil was analyzed on an Agilent gas chromatograph (GC-FID) Model 6890, equipped with a HP-5 ms fused silica capillary column having (5%-phenyl) methylpolysyloxane stationary phase (25 m x 0.25 mm, film thickness 0.25 µm), programmed from 50°C (5 mn) to 250 °C at 3°/mn and held for 10 mn. Injector and flame ionization detector temperatures were 280 and 300 °C, respectively. The essential oil was diluted in acetone 3.5% (v/v) and injected in split mode (1/60), hydrogen was used as a carrier gas (1.0 mL/mn). Solutions of standard alkanes (C8-C20) were analyzed under the same conditions to calculate retention indices (RI) with Van delDool and Kratz equation. Mass spectrometry was performed on an Agilent gas chromatograph-mass spectrometer (GCMS) Model 7890/5975, equipped with HP-5 capillary column (25 m x 0.25 mm, film thickness 0.25 µm) programmed

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Table 1: Retention times, Retention indices and percentage composition of the essential oil of *Pulicaria undulata*

Peak N°	RT	[b]RI	[a]Compound	%
1.	8.753	1099	Linalol	2.4
2.	8.839	1103	Thujol	0.9
3.	9.556	1142	camphor	0.2
4.	10.016	1166	borneol	0.8
5.	10.214	1177	terpinen-4-ol	2.8
6.	10.379	1186	thujanol	4.7
7.	10.491	1192	cis mentan-2-one	0.7
8.	10.626	1199	trans menthan-2-one	0.6
9.	10.805	1209	transpiperitol	1.5
10.	11.546	1252	carvotanacetone	14.8
11.	12.438	1303	carvacrol	3.1
12.	14.082	1404	2,5-dimethoxy-p-cymene	0.8
13.	14.238	1414	β-caryophyllene	0.8
14.	15.111	1472	γ-muurolene	0.9
15.	15.266	1482	amorpha-4,7(11)-diene	1.0
16.	15.345	1487	epi-cubebol	1.1
17.	15.469	1495	α-muurolene	2.1
18.	15.676	1509	γ-cadinene	1.9
19.	15.811	1518	δ-cadinene	8.2
20.	16.103	1539	α-cadinene	0.4
21.	16.204	1546	α-calacorene	0.2
22.	16.561	1570	palustrol	0.3
23.	16.628	1575	epi-globulol	0.7
24.	16.783	1586	caryophyllene oxyde	1.2
25.	17.051	1605	oplopenone	0.8
26.	17.127	1610	Humuleneepoxide II	1.3
27.	17.381	1630	cadina-4,1(10)-diene-7-□-ol	0.8
28.	17.548	1642	epi-α-cadinol	3.4
29.	17.571	1644	epi-α-muurolol	2.2
30.	17.753	1658	α-cadinol	4.7
31.	19.707	1804	14-hydroxy-α-muurolene	3.1

[a]Compounds listed in order of their RI

[b]RI (retention index) measured relative to n-alkanes (C8-C20) using HP-5 ms

with the same conditions as for GC-FID. The mass spectrometer (MS) was in electron impact mode at 70 eV and electron multiplier was at 2200 V. Ion source and MS quadrupole temperatures were 230°C and 180°C, respectively. Mass spectral data were acquired in the scan mode in the *m/z* range 33-450. The essential oil constituents were identified by matching their mass spectra and retention indices (RI) with those of reference compounds from libraries such as Adams[23] and McLafferty & Stauffer[24]. The proportions of the identified compounds were calculated by internal normalization.

RESULTS AND DISCUSSION

The steam distillation of the aerial parts of *P. undulata* yielded 1.2 % (w/w) of yellowish oil with a perfumery odor. Thirty one constituents representing about 68.4% of the total essential oil of the plant were identified, among which 74.3% of oxygenated compounds. All the identified compounds are listed in table 1 in order of their experimental retention times and retention indices. The major constituents were carvotanacetone (14.8%) followed by δ-cadinene (8.2%), α-cadinol (4.7%), thujanol (4.7%), epi-α-cadinene (3.4%), carvacrol (3.14%) and 14-hydroxy α-muurolene (3.1%). A literature survey showed that carvotanacetone has been reported as major component in *P. undulata* essential oil from South Yemen and Sudan (91.4%, and 55.87% respectively)[25,26]. This compound is also accumulated as major component in other *Pulicaria* species such as *P. inuloides* and *P. jaubertii* from Yemen (47.3 and 63.9% respectively[21,27], *P. mauritanica* from Morocco (87.3%)[28] and *P. jaubertii* from Saoudi Arabia (98.6%)[29]. Our results showed significant differences with previous studies on this genus, since carvotanacetone represented only 14.8% of the total oil composition, while the other main components of our samples were δ-cadinene (8.2%), α-cadinol (4.7%), epi-α-cadinol (3.4%), and thujanol (4.6%). These main oxygenated sesquiterpene components of our sample seem to be specific to the Algerian species and were not detected in previous studies on this genus.

CONCLUSION

The essential oil of *P. undulata*, collected from Djanet region is characterized by the main presence of carvotanacetone (14.8%), δ-cadinene (8.2%), α-cadinol (4.7%), epi-α-cadinol (3.4%), and thujanol (4.6%). We also note that the chemical composition of the Algerian sample differs from those reported in the literature**.** The

level of carvotanacetone in our sample is not so high as in the case of the other samples previously studied. The other main components of the Algerian species were not detected in the previous studies. These variations may be explained by the different climates, seasons, geographic and soil conditions as well as altitude differences and harvest periods of the plant.

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