

Phytochemical Analysis of the Essential Oil from Aerial parts of *Pulicaria undulata* (L.) Kostel from Sudan

Hatil Hashim EL-Kamali¹, Mohammed Omer Yousif², Osama Ibrahim Ahmed² and Sabir Suliman Sabir²

¹ Botany Department, Faculty of Science and Technology, Omdurman Islamic University, P.O. Box # 382, Omdurman, Sudan.

² Chemistry Department, Faculty of Science and Technology, Omdurman Islamic University, P.O. Box # 382, Omdurman, Sudan.

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Abstract

The yield of steam distillation of aerial parts of *Pulicaria undulata* essential oil (2.5%); and its chemical constituents were determined. The Gas Chromatography-Mass Spectrometry (GC/MS) technique was used for the analysis of the oil. Several oil components were identified based upon comparison of their mass spectral data with those of reference compounds published in literature or stored in a computer library. The oil was characterized by the high content of the oxygenated monoterpenes which constituted 68.28 % in which (+)-carvotanacetone (55.87 %) was the major constituent. *Pulicaria undulata* oil was characterized by the presence of many components which could have numerous applications in food, pharmaceutical and perfume industries.

Key words: Essential oil composition, *Pulicaria undulate*, (+)-carvotanacetone, Beta-linalool, thymol.

Introduction

The chemical constituents of essential oils are terpenoids, phenyl propanoids and their oxidation products which are all known to qualitatively and quantitatively vary in plants depending on environmental and genetic factors as well as extraction methodologies used. The most widely used analytical method for essential oils analysis is gas chromatography which is far more sensitive than

other chromatographic methods, such as TLC.

Pulicaria undulata is densely white – woolly branched erect herb. Leaves crowded, dentate, oblong to linear at the apex, auriculate - amplexicaul at the base. Flower heads yellow solitary terminal or sub-terminal on peduncules (Andrews, 1956).

The composition of the steam distilled oil of the fresh aerial parts of *P. undulata* (L.) Kostel (from Saudi Arabia) was investigated by coupled GC/MS. The oil is rich in phenolic compounds and monoterpene hydrocarbons and comparatively low in sesquiterpene hydrocarbons (Mossa *et al.*, 1987). The essential oil of *Pulicaria undulata* aerial parts exhibited activity against Gram-positive and Gram-negative bacteria (EL-Kamali *et al.*, 1998). The aim of this research work was to analyze the essential oil of the *Pulicaria undulata*, for the first time by using GC/MS, to identify their composition of volatiles.

Materials and Methods

Plant material

The aerial parts of *Pulicaria undulata* were collected in November 2008, from EL-Fiteehab region, University City Campus of Omdurman Islamic University in Omdurman South. It was taxonomically identified at the Department of Botany, Faculty of Science and Technology, Omdurman Islamic University.

Preparation of the essential oil:

The finely dry powdered aerial parts (385 grams) were subjected to steam distillation using steam distillation apparatus. The obtained oil (2ml) was collected, and dried over anhydrous sodium sulphate and kept at 4 °C until analysis.

GC/MS analysis

GC/MS analysis was conducted using a Shimadzu QP 2010 GC/MS instrument equipped with reference libraries. The flow rate of helium as carrying gas was (1 ml/min). The temperature program consisted of 60 – 270 °C, with rate of 4 °C /min. MS were taken at 70 eV. Library search was carried out using Wiley GC/MS library. The individual identifications were made by the comparison of

fragmentation patterns with those found in the library of the Mass spectrometer.

Results and Discussion

The yield of volatile oil of *Pulicaria undulata* obtained by steam distillation of the finely powdered aerial parts was 2.5 %. The oil was light yellow and with a perfumery odor. The GC/MS chromatogram of the oil revealed the presence of 70.97 % monoterpenes and 10.0 % sesquiterpenes (Table 1) that were identified through comparison of the fragmentation patterns in the resulting mass spectra with those published in literature (Adams, 2001) and using the Wiley mass spectral database of the gas chromatograph computer .

This, to the best of our knowledge, represents the first comprehensive GC/MS analysis of *P. undulata* aerial parts from Sudan. It is worth mentioning that there was a brief report on the analysis of *P. undulata* using GLC/MS by EL-Egami (1989) which reported six terpenes : carvotanacetone, linalool, nerol, eugenol , menthone and limonene, unlike the previous analysis by EL-Egami (1989) which reported the presence of nerol, eugenol and menthone in *Pulicaria undulata* from Shambat and Taiba regions.

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Table 1. Composition of the essential oil of *Pulicaria undulata*.

No.	Compound	%
1	2-Butanol	0.05
2	alpha-pinene	0.42
3	alpha-phellandrene	0.32
4	cymene	1.20
5	(+)-limonene	0.21
6	Eucalyptol	0.14
7	unidentified	0.08
8	Beta-linalool	4.55
9	Nonanal	0.10
10	1-methyl-4-(1-methylethyl)-2-cyclohexen-1-ol	0.09
11	(+)-camphor	

0.20		
12	1,3-dimethyl cyclohexene	0.06
13	Borneol	0.56
14	Isobornyl formate	2.70
15	alpha-terpineol	0.38
16	unidentified	0.10
17	1-Decanal	0.06
18	unidentified	0.27
19	Thymol methyl ether	0.26
20	Sabinyol acetate	0.44
21	(+)-carvotanacetone	55.87
22	unidentified	1.40
23	Bornyl acetate	0.08
24	Cyclododecyl-1-ethanone	2.00
25	1-methyl carvacrol	0.76
26	3-methyl-4-iso-propyl phenol	0.65
27	4-carene	0.34
28	unidentified	0.7
29	1,4-Ethanonaphthalene	0.25
30	unidentified	1.60
31	2-tert-butyl-1,4-dimethoxy-benzene	2.20
32	Beta-caryophyllene	2.99
33	Ethyl cinnamate	2.78
34	Thymol	3.01
35	alpha-curcumene	0.13
36	2,6-octadien-1-ol	0.17
37	alpha-Guaiene	0.40
38	Gamma-cadinene	0.38
39	Spathulenol	0.84
40	unidentified	1.62
41	unidentified	1.66
42	unidentified	3.60
43	unidentified	1.76