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Research Article

Phytochemical Composition of the Essential Oil from the aerial part of *Achillea tomentosa* L. in Irbid, Jordan

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ABSTRACT:
The phytochmical composition of essential oil of *Achillea tomentosa* L.(Asteraceae) aerial part collected from Irbid (Jordan)was analyzed using Gas Chromatography- Mass Spectrometry (GC-MC). Forty five compounds were identified depending in retention index (RI) and mass spectra (MS) that form 98.75 %of the essential oil composition. The result showed that the ratio of the identified compounds range between 0.07 % and 23.93 %, 3-Carene (23.93 %), Limonene (11.79 %) and α-Terpinyl acetate (9.78%) were found to be the main constituents of the essential oil. m-Cymene (6.65 %), Di-n-octyl phthalate (4.83 %), α-Pinene (4.56 %) and 1,8-Cineol (3.55 %) present in moderate quantities. The phytochmical analyzes showed that the identified compound quantitatively and qualitatively differ from the previous study that investigate the composition of *A.tomentosa* L. essential oil.

Key words: *Achillea tomentosa*, Asteraceae, essential oil, phytochemical composition, 3-Carene.

INTRODUCTION

In recent decades, the emergences of antimicrobial resistant microorganisms cause serious problems for both medical and food production industries[1]. Different multi-antibiotic resistant pathogenic bacteria were isolated from patients with different infections[2]. In addition, the stability and safety of processed food reduced due to the appearance of antimicrobial resistant microorganism that causes food spoilage[3]. To solve these problems the researchers direct their efforts toward the investigation the antimicrobial activities of plant secondary metabolites such as plant extracts and essential oils[4].

Essential oils that were widely investigated for their biological activity are a kind of biological valuable plant products that possessed antimicrobial, antioxidant, and/or inhibition of enzyme activity. Essential oils contain a mixture of constituents that have wide variety of plant secondary metabolites have the ability to affect the growth of microorganisms[5].

Jordan is a small sized country that has unique biodiversity of flora among this flora there is a number of plant species that used as medicinal plant in alternative medicine practice. *Achillea tomentosa* L. that belongs to the genus *Achillea* that represented by more than 140 species widely distributed in Middle East[6]. The aerial part infusion of *A. tomentosa* used in Jordan for the treatment of stomachache[7], Intestinal colic, as carminative and muscular relaxant of uterus and arteries[8].

There is only one single study that investigates the phytochemical composition of the essential oil extracted from the flower of *A. tomentosa* L. that conducted in Italy by Chizzola[9]. To the best of our knowledge, there are no comprehensive studies performed to investigate the phytochemical compostion of *A. tomentosa* L.essential oil. This study aims to analyze the phytochemical profile of essential oil extracted from aerial part of *A. tomentosa* L. in Jordan and to compare this profile to previous study.

MATERIALS AND METHODS

Plant Material

The aerial parts of wild *Achillea tomentosa* plant were collected in May 2016 at the bloom stage from Irbid (32°30'11.6"N 35°56'10.1"E), Jordan. The plant sample was identified by plant taxonomist and voucher specimens were deposited in the Ibn Albitar herbarium, Faculty of Sciences, Al Al-Bayt University.

Essential oil Extraction

The essential oil was extracted by steam in a modified Clevenger-type apparatus for 3 h. After distillation, the collected oil was separated from the water using separatory funnel and dried over sodium sulfate (water free) then stored at 4°C for further analysis[10].

Gas Chromatography Coupled with Mass Spectrometry Analysis (GC-MS)

The identification of different chemical compounds was realised by gas phase chromatography (TRACE GC-ULTRA, S/N 20062969, Thermo-Fischer) coupled with mass spectrometry (PolarisQ, S/N 210729, Thermo Fischer) (GC/MS). The utilized column was Varian capillary column Test Report CP 7770 (CP-SIL- 5 CB; 50m length, 0.32mm of Inside diameter, 0.45mm Outside diameter and Film thickness 1.20 µm). The column temperature was programmed from 40 to 260°C for 5°C/min. The temperature of the injector was fixed to 250°C and the one of the detector (PolarisQ) to 200°C.

Ionisation of the sample components was performed in electron impact mode (EI, 70 eV). The debit of gas vector (Helium) was fixed to 1ml/min. Transfer line temperature was 300°C. The mass range from 40 to 650 amu was scanned at a rate of 2.9scans/s. The volume of injected specimen was of 1µl of diluted oil in hexane solution (10%). The constituents of essential oils were identified in comparison with their retention indices, calculated in relation to the retention time of a series of lineary alkanes (C4- C28) with those of reference products and in comparison with their retention indices with those of the chemical components gathered by 47 and in comparison with their specters of mass with those gathered in a library (NIST-MS Search Version 2.0) and with those reported in the literature[10].

RESULTS AND DISCUSSION

The essential oil of *A. tomentosa* L. aerial parts collected form Irbid (Jordan) was extracted using steam distillation method, the yield of the oil was 1.1 %. The phytochemical composition of the *A. tomentosa* L. essential oil analyzed by GC-MS and identified using by comparing mass spectra of the EO with the Wiley library, or with the published mass spectra is showed in table 1. A total of 45 were identified representing 98.75 % of the essential oil. The result showed 3-Carene (23.93 %), Limonene (11.79 %) and α-Terpinyl acetate (9.78%) were found to be the main constituents of the essential oil. The identified compound qualitatively and quantitatively differ from the result of the only single study conducted by Chizzola[9] in which 1,8-cineol (eucalyptol) (56.1 %) and α-pinene (15.3 %) were main component of *A. tomentosa* L. essential oil.

Other compound such m-Cymene (6.65 %), Di-n-octyl phthalate (4.83 %), α-Pinene (4.56 %) and 1,8-Cineol (3.55 %) present in moderate quantities, which also varies from the study of Chizzola[9] in which Linalool (4.7 %), α-terpineol (3.3 %), β-pinene (2.4 %) and terpinen-4-ol (2.3 %) were present in moderate quantities. As mentioned by previous studies different factors such as animal activity, harvesting time, temperature, developmental stage, geography, growth conditions can cause quantitative and qualitative variations in the chemical constituents of essential oil[11-14].

Comparing to closely related species *Achillea millefolium* several studies were reported that some chemotypes have 1,8-cineole, β-pinene, sabinene, camphor, linalool or ascaridol as main essential oil constituents[15], other chemotypse have chamazulene as major constituent and high proportions of β-caryophyllene or nerolidol in their oils[16-18].

The structure-types and individual compounds of the essential oils appeared to be valuable markers for chemotaxonomic investigations in the view of evolutionary relationships while the level of oxygenation is mainly determined by environmental factors that affect the plant growth[19]. Furthermore, essential oil phytochemicals belong to majority of the terpene family, thousands of phytochmical consituentes of essential oils belonging this family have so far been identified[20].

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Table 1. Phytochmical composition of the essential oil of *A. tomentosa* L.

Compound	RI	%
α-Thujene	933	0.46
α-Pinene	941	4.56
Camphene	953	0.72
β-Thujene	964	1.24
Thuja-2,4(10)-diene	968	2.98
3-Carene	1012	27.93
m-Cymene	1019	6.65
1,8-Cineol	1029	3.55
γ-Terpinene	1052	2.52
2-Nonanone	1074	2.25
Linalool	1102	0.59
n-Amyl isovalerate	1107	0.17
Cosmene	1113	0.28
β-Thujone	1118	1
Amylisovalerate	1120	0.24
cis-β-terpineol	1125	0.71
Camphor	1137	2.38
Lavandulol	1157	0.39
2,3-Dehydro-1,8-cineole	1161	0.16
Terpinen-4-ol	1165	1.45
cis-Piperitol	1185	0.62
α-Terpineol	1194	0.67
Myrtenol	1201	0.13
Limonene	1214	11.79
(Z)-Chrysanthenyl acetate	1255	1.95
Lavendulyl acetate	1273	0.65
L-Bornyl acetate	1283	1.24
α-Terpinyl acetate	1351	9.78
Cyclosativene	1373	0.28
α-Copaene	1389	0.97

β-Caryophyllene	1425	0.35
α-Humulene	1457	0.18
4,11-Selinadiene	1472	0.18
a-Selinene	1487	2.51
Bicyclogermacrene	1498	0.22
β-Sesquiphellandrene	1520	0.07
(E)-Nerolidol	1534	0.73
Germacrene B	1559	0.19
Spathulenol	1583	0.25
Caryophyllene oxide	1595	0.13
c-Eudesmol, 10-epi-	1617	0.21
β-Eudesmol	1637	0.15
Isophytol	1949	0.1
Phytol	2115	0.34
Di-n-octyl phthalate	2681	4.83
Total		98.75

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