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Research Article

A study to determine chemical composition of *Convolvulus althaeoides* L. Plant by using (GC-MS)

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Abstract— Plants are an important source of human health, as the pharmaceutical industries today have come to rely on medicinal plants to produce pharmaceutical compounds due to the traditional relationship with them, and the ease of obtaining them and their safety. This study aimed to identify the biochemical compounds which present in flowers, leaves and roots of the species *Convolvulus althaeoides* L., samples were collected from the Salunfa region of the Lattakia - Syria, during the month of July 2022. The plant extract was obtained using an ultrasound device. It was analyzed by using a chromatography device. Gas spectrometry (GC/MS). 25 compounds were identified in flowers, 14 compounds in roots, and 6 compounds in leaves. The highest percentage of hydrocarbons was in the flowers (25.5%), followed by the roots (7.756%), while a small percentage was recorded in the leaves (2.61%). The two most important compounds were Heptadecan and Eicosane, which have been proven effective as anti-inflammatory in kidney tissue. Fatty acids were found in the flowers (10.26%).) As for the roots (15.73%) and is absent from the leaves, one of its most important compounds is Palmitic acid. Or called C16, it is an important antimicrobial, anti-hemolytic, antioxidant, and cholesterol-lowering agent. Isopropyl linoleate, which belongs to the ester group, is found to have antioxidant, antimicrobial, and anti-cancer activity. This species is a source of bioactive compounds potentially used in medical applications.

Keywords— *Convolvulus althaeoides*. L, Gas Chromatography (GC/MS), ultrasound device, chemical compounds. Carboxylic acids

1. Introduction

The genus *Convolvulus* L. is a polymorphic plant and belongs to the phylum Angiosperms-Magnoliophyta, the phylum Magnoliopsida-Dictyledonaea, the subclass Asteridae, the Solanal order, and the *Convolvulacea* family [1].

[2] stated that the center of distribution of the genus Convolvulus is southwest Asia, where large numbers of endemic species occur in that geographical area. [3] confirmed that most of the original ancestors of the genus Convolvulus were widespread in many countries of Asia. The Alaf genus includes approximately 100 species distributed globally [4], of which there are 22 species in Syrian and Lebanese territories, of which 6 species have been recorded in Latakia Governorate: *C. arvensis* L. *C. althaeoides* L. *C. cantabrica* L. *C betonisifolius Mill*. *C. dorycnium* L. *C. scammonia* L. [5].

Medicinal plants are known as a rich source of bioactive chemicals and are used in the pharmaceutical industry [6], and species of the genus have shown important medicinal properties since the 1730s [7].

Its extracts are still of interest to researchers, due to its important phytochemical composition, bioavailability, effectiveness, clinical safety, and the effect of its plants on the central nervous system [8]. Studies have also shown that species of this genus contains a wide range of chemical compounds such as phenols, which are effective antioxidants [9], saponins, steroids, alkaloids, proteins, fatty acids [10], and polyphenol compounds [11], flavonoids [12,13] , And coumarins [14], volatile oils, carbohydrates, tannins, as well as lactones and amino acids [15].

Recently, many researches have been carried out on the biological activities of species of the genus Purlin (whole plant, aerial parts, flowers, or leaves), such as the antioxidant effects of C. pilosellifolius and C. prostratus, both in vitro and in vivo [16].

2. Related Work

Many researchers also found a correlation between the phenolic content in *C. arvensis* and antioxidant activity, and it could be used as a food preservative, especially meat [17]. In addition to the antibacterial and antifungal activity of *C. arvensis* [18].

Most species of the genus Purlin, with its various parts, have anti-cancer cell proliferation activity. Aqueous and methanolic extracts of the of *C. arvensis*, as well as its leaves, showed toxic effects on rhabdomyosarcoma (RD) cells in humans [19,20]. The ethanolic extract of the aerial parts of *C. arvensis* also reduced the number of live lymphoblastic leukemia cells [21]. This activity has been linked to the presence of anti-cancer compounds as in extracts of the flowers of *C. althaeoides*. Such as caryophyllene, β-caryophyllene [22]. Analysis of plant extracts is a modern approach to finding therapeutically effective compounds [23]. The aim of this study was to find the phytochemicals/bioactive compounds present in (flowers, leaves and root) of the *Convolvulus althaeoides* L. plant. Distributed in the Syrian environment, by gas chromatography and mass spectrometry (GC-MS) analysis. However, to our knowledge, no similar report has been published for *C. althaeoides* L. Until now.

3. Experimental Method

3.1. Materials

Root samples were collected in the fall, while the leaves were collected in the spring, as they are rich in active ingredients, and the process of photosynthesis is more active, and this stage that precedes flowering is the best stage for collecting leaves, while the period for collecting flowers is very short and requires Precision and care in choosing the appropriate time to collect them. In general, flowers are collected before blooming or as soon as they bloom [24].

The three parts of the plant (root, leaf, flower) were collected from Selnfi (in Syria) ; the town is located 50 Km east of lattakia and is located in the herrt of thecoastal Mountains of Syria , they are collected at spring of 2021.

3.2. Methods

3.2.1. Preparation of Plant Extracts:

Freshly collected roots; leaves and flowers of C. althaeoides. were washed with running tap water, they were dried under shade for two weeks, Then were powdered separately in an electric blender, after that were kept in airtight containers to avoid the effect of humidity and then stored at room temperature until use, then 25 g was taken from each ground sample, then extracted with hexane and dichloromethane by ratio (1:1) in an ultrasonic device at a temperature of 25ºC, the extraction time was 60 minutes, and the volume ratio of the raw material to solvent was 1g to 3ml. And the applied power is 150 W, within the ultrasound bath [25].

The resulting extract was concentrated up to 15 ml in a rotary evaporator to be ready for subsequent analysis on a gas chromatography device with a mass spectrometry detector (GC-MS)

3.2.2. Gas Chromatography-Mass Spectroscopy (GC-MS) Analysis

GC-MS analysis of these extracts were carried out by using the equipment GC Clarus 500 Perkin-Elmer system comprising a AOC–20i autosampler and gas chromatograph interfaced to a mass spectrometer (GC-MS) instrument employing the following condition: Equipped with a column Elite-1, silica capillary column (30 m × 0.25 mm ID × 1μm df, composed of 100% dimethyl polysiloxane), operating in electron impact mode at 70 eV; helium gas (99%) was used as carrier gas at a constant flow rate of 1 ml/min and an injection volume of 2 μl was employed (split ratio of 10:1). The injector temperature is set at 250 °C, and the ion-source temperature is 280 °C. The oven temperature was programmed from 110 °C (isothermal for 2 min), with an increase for 10 °C/min, to 200°C/ min, then 5°C/ min to 280 °C/min. Mass spectra were taken at 70 eV; a scan-interval of 0.5 seconds, and fragments from 45 to 450 Da. Total running time was 36 min. The relative percentage amount of each component was calculated by comparing its average peak area to the total areas.

Interpretation on mass spectrum of GC-MS was conducted by using the database of National Institute of Standard and Technology (NIST).
The spectrum of the unknown component was compared with the spectrum of the known components stored in the NIST library [26,27].

4. Results and Discussion

The results of chemical analysis by GC-MS of the roots, leaves and flowers of C. althaeoides plants showed the presence of a wide spectrum of active chemical compounds. These compounds varied in their type and quantity by depending on the plant part studied.

(Table 1) and (Figure 1) 14 compounds were detected in the roots of *C.althaeoides* plants and the total percentage of hydrocarbons reached(7.756%), and the percentage of fatty acids reached (15.73%) (the most important of which is n-Hexadecanoic acid (Palmitic acid).) or called (C16) C16H32O2, whose percentage reached (13.02%) and is considered an antimicrobial [28], anti-androgen, hemolytic, antioxidant, cholesterol-reducing and works as a 5-Alpha enzyme that inhibits oxidative chemical processes [29].

The compound(C21H38O2) Isopropyl linoleate, which belongs to the ester group, recorded a value of (9.11%), which is an effective antioxidant [30], and possesses antimicrobial and anti-cancer activity [31], and the group was also present Ketones and terpenes were present in one compound each, with a small percentage (0.86% and 0.19%), respectively. Chlorinated hydrocarbons were present in two compounds, with a percentage of (2.01%). As for alcohols, their total percentage was (3.09%) and were represented by two compounds: Octadecatrien-1-ol and Hexadecanol.

[32] found, after GC-MS chromatographic analysis, that the percentage of the compound for the same species growing in Tunisia was (29.77%), that is, higher than what we found in this research. This is explained by the difference in soil properties, climatic conditions, and environmental conditions in which it grows. In which the plant, which would affect the morphological form of the plant species, as well as its chemical composition, in addition to the age of the plant, genetic factors, and the method of extraction [33, 34].

The results of the analysis of the species' leaves (Table 2) showed that it contains 6 compounds, the most important of which are hydrocarbons, with four compounds, and their total percentage reached (2.61%), where the compound Eicosane (C20H42) recorded the percentage (1.46%), which is characterized by its role as an antifungal (Nandhini, 2015; Karanja et al., 2012), followed by Nonadecane with a percentage of (0.53%), while Benzenedicarboxylic acid diis ooctyl ester, which belongs to the ester group, recorded a percentage of (0.66%). As for the amine group, the compound β-Lutidine 1 recorded a percentage of (0.35%). (Figure 2) shows the chromatograms of C. althaeoides leaves. We notice from (Figure 3, Table 3) that the flowers are rich in bio-organic chemical compounds, as the total number of compounds reached 25 compounds, including 14 compounds, and their percentage reached (25.5%), with the highest percentage being in the compound Eicosane (10.34%), followed by the compound Heptadecane CH3(CH2)15CH3 at a rate of (8.73%). It was found that the compound Heptadecan showed an antioxidant and anti-inflammatory effect on kidney tissue [35].

While carboxylic acids were represented by eight compounds and their total percentage reached (10.26%), and chlorine hydrocarbons recorded a high value through the presence of the compound C2Cl4 Tetrachloroethylene (31.13%), which is a colorless liquid widely was used in dry cleaning of fabrics, and has a pleasant smell [36]. As for ketones and alcohols, they were recorded respectively (0.11%, 0.07).

Table 1. Chemical composition to roots of *C.althaeoides*

Functional group	Compound	%
Hydrocarbons	o-Xylene	0.30
	Cyclododecane	0.57
	Cyclotetradecane	0.59
	Eicosane	6.29
Fatty acids	n-Hexadecanoic acid	13.02
	Octadecanoic acid	0,88
	Benzenedicarboxylic acid	1.83
Ketones	Ethanone	0.86
Terpenes	Tetradecene	0.19
Chlorhydrocarbons	Heptadecene	0.77
	Tetrachloroethylene	1.24
Ester	Isopropyl linoleate	9.11
Alcohols	Octadecatrien-1-ol	2.13
	Hexadecanol	0.96

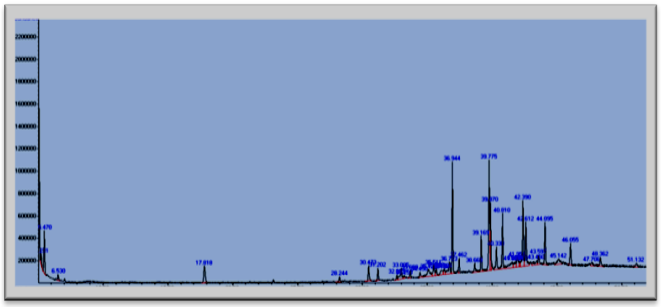

Figure 1. Chromatogram of chemical compounds to roots of *C.althaeoides*

Table 2. Chemical composition to leaves of *C.althaeoides*

Functional group	Compound	%
Hydrocarbons	Eicosane	1.46
	Docosane	0.31
	Tricosane	0.31
	Nonadecane	0.53
Ester	Benzenedicarboxylic acid diis ooctyl ester	0.66
Amines	*β*-Lutidine 1	0.35

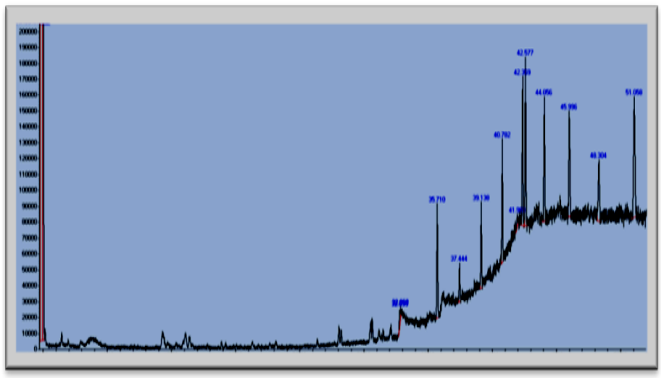

Figure 2. Chromatogram of chemical compounds to leaves of *C.althaeoides*

Table 3. Chemical composition to flowers of *C.althaeoides*

Functional group	Compound	%
Hydrocarbons	Eicosane	10.34
	Docosane1	0.42
	Tetracosane	0.55
	Octacosane	0.61
	Heptadecane	8.73
	Heneicosane	0.82
	Cycloeicosane	0.70
	Hexadecane	0.10
	Octadecane	2.82
	Cyclododecane	0.04
	Nonadecane	0.14
	Methyltritriacontane	0.05
	Bicyclo[3.1.1]heptane	0.06
	Octasiloxane, 1,1,3,3,5,5,7,7,9,9, hexadecamethyl	0,12
Chlorhydrocarbons	Tetrachloroethylene	31.13
Ketones	Undecanone 6,10-dimethyl	0.11
Alcohols	Hexadecano1	0.07
Fatty acids	Tetradecanoic acid	1.39
	Heptadecanoic acid	0.07
	Nonanoic acid	0.45
	Benzenedicarboxylic acid	3.77
	Tricosanoic acid	0.44
	Tetracosanoic acid	3.56
	Pentacosanoic acid	0,13
	Hexacosanoic acid	0.38

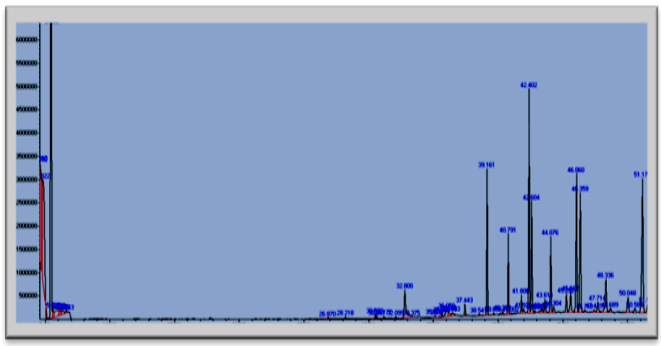

Figure 3. Chromatogram of chemical compounds to flowers of *C.althaeoides*

5. Conclusion and Future Scope

The current research is the first of its kind to identify the chemical compounds of roots, leaves and flowers of *Convolvulus althaeoides* L. The flowers showed the largest portion of the active chemical compounds, followed by the roots, while the leaves were less diverse. The most prominent chemical groups in the plant were hydrocarbons, carboxylic acids and esters, the most important acid compounds. Heptadecan, and Isopropyl linoleat are antioxidants superior. In addition, they are important to other medicinal properties, so we recommend conducting future studies to isolate and purify these compounds, test their effectiveness, and study their applications.

Data Availability
Not applicable

Conflict of Interest
The authors declare that they have no competing interests.

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Contributions
The author has actively participated on concept and design, data acquisition, interpretation of data and drafting the manuscript as well as critical review and final approval of the manuscript to be submitted.

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