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Chemical Composition of the Essential Oil of *Ruta chalepensis* Growing Wild in Syria

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Abstract Background: Knowledge of the chemical composition of essential oils is a very important quality criterion for their marketing and contributes to their commercialization as functional ingredients in food technology or in phytopharmacy. Objectives: The aim of this work is to identify the Chemical composition of *Ruta chalepensis*, collected from Slayb Al-Turkman - Lattakia – Syria. Essential oil was investigated. Material and Methods: Essential oil was extracted by hydrodistillation; it was analyzed by using gas chromatography-Mass Spectrometry (GC/MS). Results: The highest yield of essential oil was obtained at the flowering stage (May-June) (1.23-1.35 %) (V/W).The chemical composition of essential oil was analysed by (GC/MS). The results exhibited 2-Undecanone (43.32%) and 2-Nonanone (40.27%). Conclusion: the essential oil was isolated from *Ruta chalepensis*, which used in traditional medicine. This plant is now being studied in Syria for the first time.

Keywords Medicinal plant, organic matter, Alkaloids, furanocoumarins

Introduction

There is a growing scientific interest focused on medicinal, aromatic plants and their derivatives such as essential oils, known for their fragrances and by their important biological and industrial properties also. The chemical composition of essential oils depends on a large number of parameters, namely climatic, seasonal and geographic conditions, harvest period, extraction technique and plant organs, among others.

Indeed, knowledge of the chemical composition of essential oils is a very important quality criterion for their marketing and contributes to their commercialization as functional ingredients in food technology or in phytopharmacy [1].

Ruta chalepensis. is an aromatic plant belonging to the Rutaceae family, commonly named by local population as "Sdab or Zbad" It is a perennial herb growing up to 80 cm tall, widely spread in the Mediterranean area and usually growing on rocky slopes [2].

Ruta is old Latin plant name for rue; the same word means also bitterness, unpleasantness, perhaps referring to the strong smell or taste of rue. 'Chalepensis' is originated from or first collected at Aleppo, Syria [3]. Its flowers are cymes with 4-5 sepals, 4-5 petals, 8-10 stames and a superior ovary [4-5].

Ruta chalepensis is still used in the traditional medicine of many countries for the treatment of a variety of diseases [2]. Decoctions of the leaves have been given internally as an antispasmodic, analgesic, antipyretic, anti-inflammatory, and sedative remedy, and for the treatment of menstrual problems, rheumatism, and mental disorders [2]. The aerial parts of this plant used as a remedy for epilepsy, as an insect repellent, and for the treatment of psoriasis (macerated in olive oil). The juice obtained from heated leaves has been used externally for earaches and headaches and as antiseptic drops for ear and eye infections [5-6]. *Ruta chalepensis* has also been reported to have

antifungal activity against dermatophytes [7] and has been described for its anti-infertility, anticonvulsant, and sedative effects [8].

In recent years, several studies have been performed on the chemical composition of the essential oils (EOs) isolated from Ruta species with different origins. There are a number of phytochemical studies on the essential-oil composition of *Ruta chalepensis* from Iran [9], Turkey [10], Tunisia [11-14], Italy [15], Algeria [16-17], and India [18]. The leaves and stems have been reported to containalkaloids, furocoumarins, coumarins, flavonoids, phenols, aminoacids, and saponins [17, 19-20].

Because of the numerous medicinal properties of *Ruta chalepensis* and its extensive use in the traditional medicine, it is of great interest to identify the chemical composition (chemo types) of its essential oil. Hence, in this study, the chemical composition of the essential oils isolated from the aerial parts (leaves or a mixture of leaves and stems) of wild-growing Syrian populations of *R. chalepensis* was reported.

There are many ways to extract the Essential oils from plants as water distillation, steam distillation, and disadvantage of direct steam distillation. Here we extracted essential oils from dried leaves by hydrodistillation using a Clevenger apparatus for 4 h at 350°C [14, 20-21].

For analysis of essential oils there is one technique used in most reference studies is the GC/MS [11, 15, 19-20].

Materials and Methods

Plant Material

The aerial parts of *R. chalepensis* were collected from the region Slayb Al -Turkman, Lattakia, Syria, (35˚41' 12.7"N 35˚48' 28.4"E) monthly from February to August during 2018. Fresh aerial parts were dried in the shade for 14 days at room temperature before the extraction of essential oils.

Essential Oils Isolation Procedure

The air-dried plant material (100 g) was subjected to hydrodistillation for 4 h using a Clevenger-type apparatus, the oil obtained was stored in a sealed vial in the dark at 4 °C until tested and analyzed.

Analysis of Essential Oils

The essential oils were analyzed by gas chromatography–mass spectrometry (GC–MS). GC analyzes were carried out using an Agilent technologies 19091j – 413 with capillary column (30m × 320 µm i.d., film thickness 0.25 µm) and connected to a MS was used , the column temperature was programmed from 70 to 230 at rate 1˚C/4 min. The carrier gas was helium with a flow rate of 1.2 ml/min and pressure 1 bar, the analyzed sample volume was two µl of essential oils.

Results and Discussion

Essential Oils Isolation

Air-dried herbal of *R. chalepensis* for samples were collected monthly from February to August were subjected to hydrodistillation and the yields of essential oils are organized in the following table 1: the proportion of the essential oil in the plant increased from February (0.5) to May and then decreased to August.

Table 1: Yields of essential oils of *R. chalepensis* leaves

Month	Yields (%)
Feb	0.55
March	0.60
April	0.66
May	1.35
June	1.23
July	1.03
August	0.67

Chemical Composition of the Essential Oil from *R. chalepensis* Leaves

Extracted essential oils from *R. chalepensis* leaves were analyzed by GC/MS. Table 2 summarizes the chemical composition of essential oils taken from *R. chalepensis* leaf. In total, eight compounds were identified. The 2-undecanone is the most predominant compound (42.64%) followed by the 2-nonanone (40.27%).

Table 2: Chemical composition of essential oil of *R. chalepensis* leaves

Compound	%	Retention time (min)
2- Nonanone	40.27	6.515
2-Decanone	1,56	9.026
Acetic acid	1.34	10.285
2-Undecanone	42.64	12.277
1-Nonene	0.13	12.555
2-Dodecanone	1.46	14.876
Hexadecanal	0.58	15.250
2-Tridecanone	0.86	18.054

The figure 1 is chromatogram GC/MS for chemical composition of *R. chalepensis* leaves essential oils.

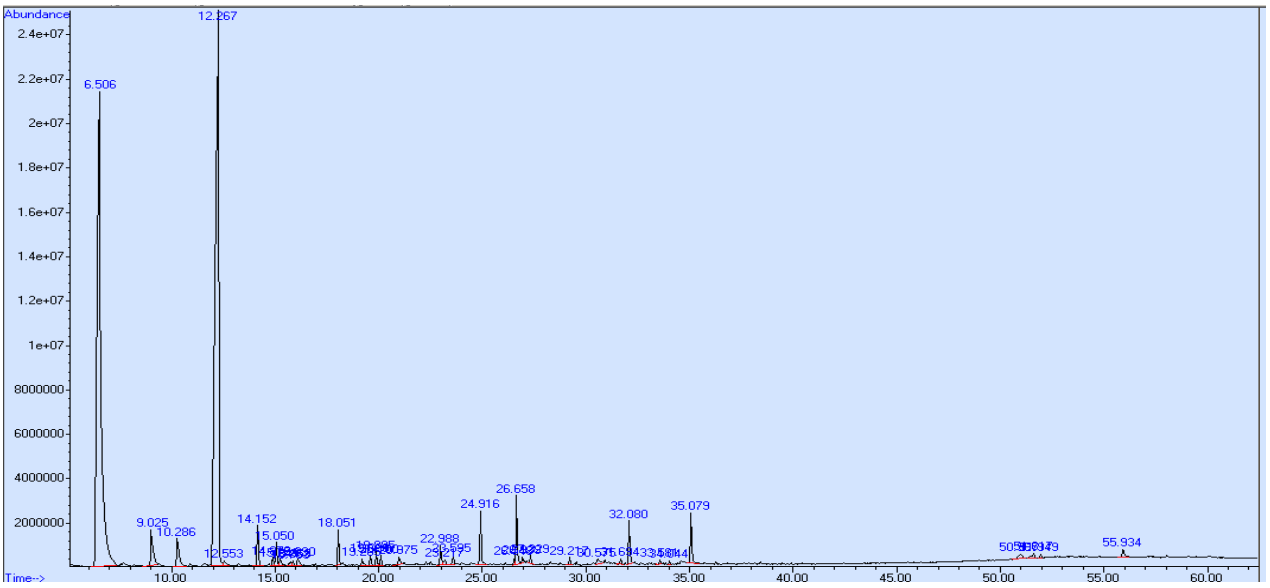

Figure 1: Chromatogram GC/MS of essential oil of R. chalepensis leaves

Chemical composition of the essential oil from *R. chalepensis* leaves

Extracted essential oils from *R. chalepensis* fruit were analyzed by GC/MS. Table 3 summarizes the chemical composition of essential oils taken from *R. chalepensis* fruit. In total, four compounds were identified. The 2-undecanone is the most predominant compound (43.01%) followed by the 2-Tridecanone (14.44%).

Table 3 Chemical composition of essential oil of *R. chalepensis* fruit

Compound	%	Retention time (min)
2- Nonanone	4.17	6.387
2-Undecanone	43.01	12.342
2-Dodecanone	4.64	15.247
2-Tridecanone	14.44	18.336

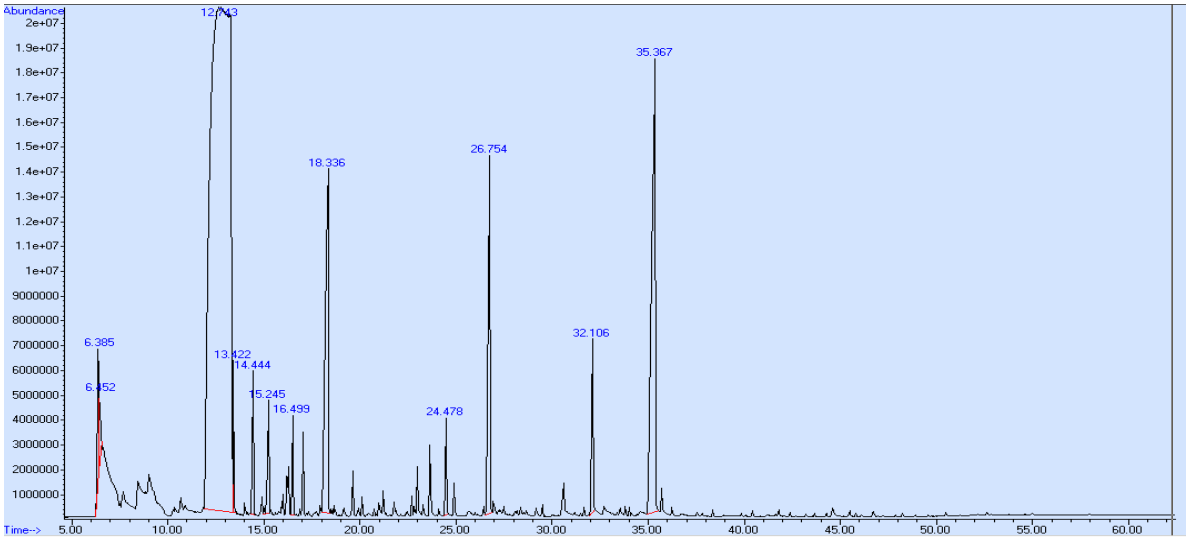

Figure 2: Chromatogram GC/MS of essential oil of R. chalepensis fruit

Conclusion

Extraction essential oils from *R. chalepensis* leaves show that the yield is greatest in May, and the analysis by GC/MS for essential oil show that the essential compound is 2-Undecanone (42.64%). The analysis by GC/MS for essential oil from fruit show that the essential compound is 2-Undecanone too but (43.01%) in addition to another chemical compounds

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