

Volatile Composition of *Ruta graveolens* L. of North of Iran

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Abstract: The chemical constituents of the essential oil of *Ruta graveolens* L. from aerial parts collected from Iran were analyzed by GC and GC/MS. The oil yield of the dried plant obtained by hydrodistillation was 0.4% (v/w). Nineteen compounds, representing for 95.2% of the oil, were identified. The main classes of compounds were found to be ketons(46.6%) and sesquiterpenoids (13.3%) and monoterpenoids (4.1%). The major constituents were 2-undecanone (33.9%), 2-Heptanol acetate (17.5%),1-dodecanol(11.0%),geyrene(10.4%) and 2-nonanone(8.8%).

Key word: Hydrodistillation • Essential oil • Chemical composition • *Rutaceae* • *Ruta graveolens* L.

INTRODUCTION

The genus *Ruta* L. belongs to the family *Rutaceae* with the common Persian name of “SODAB”, includes two species that *R. chalepensis* can be found as wild plant in south of Iran and *R. graveolens* as medicine plant was implanted in all over Iran [1].

In recent years, several studies have been performed on the chemical composition of *Ruta* species oils of different origins. For example, the seasonal dependence has been observed in the essential oil contents of fresh and dried leaves and, likewise, blossoms and fruits of *R. graveolens* L. Dried leaves are characterized by knobloch and coworkers in Germany [2] and so the essential oil of root in *R. graveolens* L. was studied by Tatti and Bos [3].

The water distilled essential oil from aerial parts of *R. chelepensis* subsp. *angustifolia* (Pers.) P.C. was investigated [4].

The essential oil of *Ruta graveolens* L. growing in Egypt studied by Aboutabl [5] and 2-nonanol; 2-nonanone; 2-undecanone; geijerene; nonyl acetate; pregeijerene detected.

So Potential alleochemicals from the essential oil of *R. graveolens* studied by De Feo [6] and undecan-2-one (46.8%) and nonan-2-one(18.8%) as the main constituents, detected .

Due to the important medicinal properties of the plant, it was thought worthwhile to identify the chemical composition of further sample of *R. graveolens* L. oil from north of Iran.

MATERIALS AND METHODS

Plant Materials: The aerial parts of *R. graveolens* L. were collected from the Lahijan, province of Guilan, in May 2007. The plants were identified and authenticated by Dr. Mozaffarian at institute of Forest and Rangelands. Voucher specimens have been deposited at the Herbarium of the Research Institute of Forest and Rangelands (TARI), Tehran, Iran.

Isolation of the Essential Oils: The dried aerial parts of the plants (100 g) were hydrodistilled in a Clevenger-type apparatus for 3.5 h. The oils were dried over anhydrous sodium sulfate and kept at 4°C in the sealed brown vials until required.

Analysis of the Oils: GC analyses were carried out on a HP-6890 gas chromatograph equipped with a split/splitless (20:1) injector (250°C) and a flame ionization detector (250°C). N₂ was used carrier gas (1 ml/min). The capillary column used was DB-5 (30 m × 0.25 mm × 0.25 µm film thickness). The oven temperature was held at 60°C for 3 min, then heated to 220°C with a 5° rate and kept constant at 220°C for 5 min. Quantitative data were obtained from GC (FID) area percentage.

GC-MS analyses were performed on a HP-6890 GC system coupled with a 5973 network mass selective detector and equipped with a HP5-MS capillary fused silica column (30 m × 0.25 mm I.D × 0.32 µm film

thickness). The operating conditions were the same conditions as described above but the carrier gas was He with 1 ml/min flow rate. Mass spectra were taken at 70 eV. Mass range was from m/z 20-500 amu.

RESULTS AND DISCUSSION

The hydrodistillation of the aerial parts of *R. graveolens* L. gave yellowish oil with a yield of 0.4% (v/w), quantitative data were obtained from the electronic integration of the FID peak areas without normalization.

The components of the oils were identified by comparison of their mass spectra and retention indices (RI) with those reported by Adams [7] and presented in the MS computer library (WILEY275).

The extracted essential oils were then analyzed by GC/MS and GC/FID on non-polar column. An example of a total ion chromatograms profile is shown in Figure 1.

In the oil of *R. graveolens* L. Nineteen components were identified, which represented about 95.2% of the total detected constituents. The major constituents of the oil were 2-undecanone (33.9%), 2-Heptanol acetate

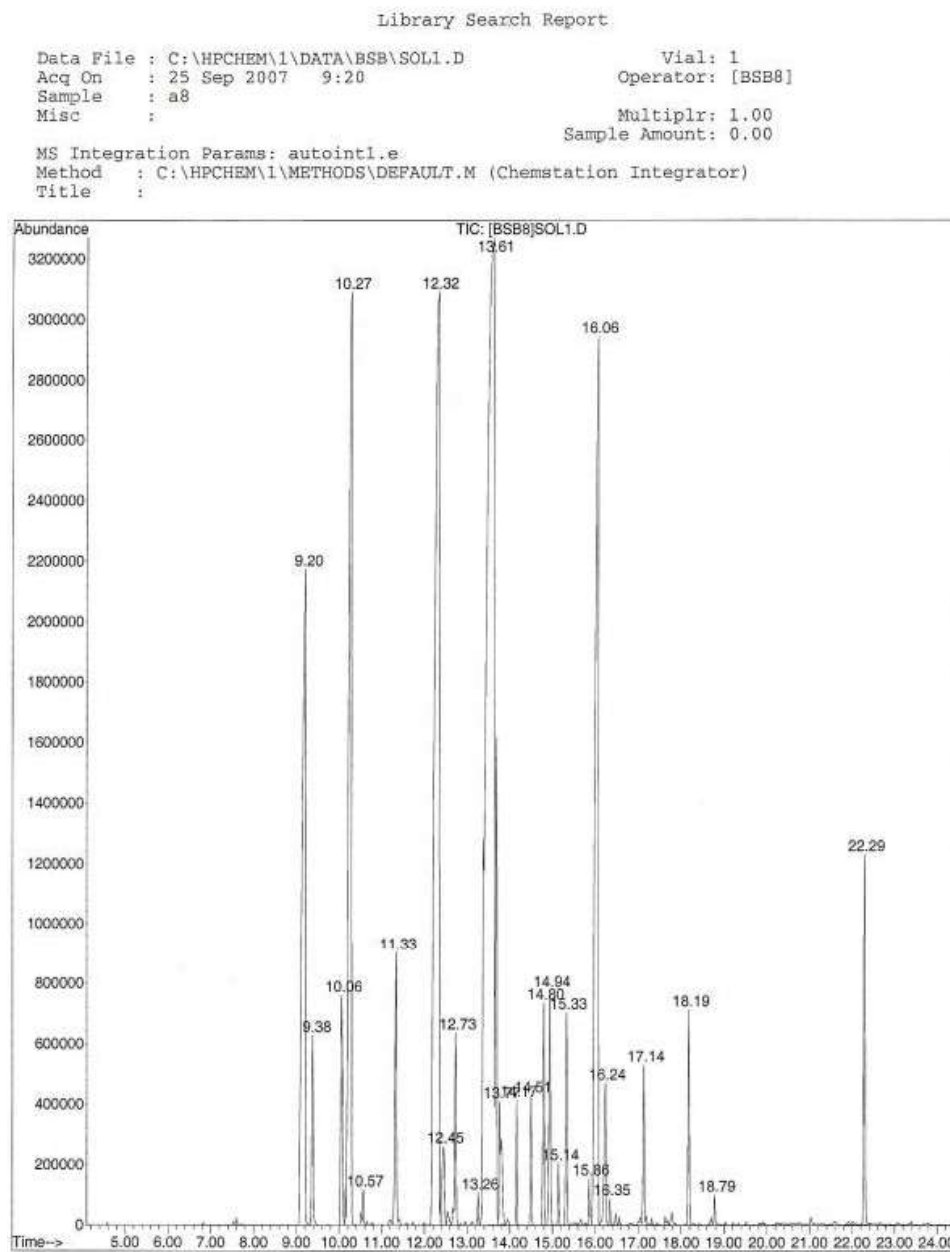


Fig. 1: Extracted essential oil GC/MS profile (DB-5 nonpolar column)

Table 1: Percentage composition of the oils of aerial parts of *Ruta graveolens* L.

| Compound ^a | RI ^b | RT ^c | Percentage (%) |
|--|-----------------|-----------------|----------------|
| 2-nonanone | 1093 | 9.20 | 8.8 |
| 2-nonanol | 1102 | 9.38 | 1.1 |
| geijerene | 1132 | 10.06 | 1.6 |
| geyrene | 1142 | 10.26 | 10.4 |
| 2-decanone | 1191 | 11.33 | 1.9 |
| 2-heptanol acetate | 1239 | 12.32 | 17.5 |
| cis-isopulegone | 1245 | 12.45 | 0.8 |
| cis-piperitone oxide | 1259 | 12.73 | 1.2 |
| benzene, Trimethyl(1-Methylethyl) | 1285 | 13.26 | 0.2 |
| 2-undecanone | 1302 | 13.61 | 33.9 |
| piperitenone | 1348 | 14.51 | 0.7 |
| 2-methyl-undecanal | 1363 | 14.80 | 1.1 |
| trans-piperitenone oxide | 1371 | 14.95 | 1.4 |
| 2-dodecanone | 1391 | 15.33 | 1.1 |
| bicyclo(7,2,0)undec-4-ene, (4, 11, 11) | | | |
| trimethyl-8-methylene | 1419 | 15.86 | 0.3 |
| 1-dodecanol | 1430 | 16.06 | 11.0 |
| 2-tridecanone | 1489 | 17.14 | 0.9 |
| elemol | 1449 | 18.18 | 1.1 |
| (-)-caryophylleneoxide | 1585 | 18.79 | 0.2 |
| Total | | | 95.2 |

^a Compounds listed in order of elution.

^b RI, (retention index) measured relative to n-alkanes (C9-C19) on the non-polar DB-5 column under conditions listed in the materials and methods section.

^cRT, retention time.

Table 2: Class composition of *R. graveolens* L. essential oil

| Class of compound | Percentage (%) |
|-------------------|----------------|
| Monoterpenoids | 4.1 |
| Sesquiterpenoids | 13.3 |
| ketons | 46.6 |
| Others | 31.2 |
| Total | 95.2 |

(17.5%), 1-dodecanol(11.0%), geyrene(10.4%), 2-nonanone(8.8%), 2-Decanone (1.9%), Geijerene (1.6%), trans-piperitenone oxide(1.4%), cis-piperitenone oxide (1.2%), 2-methyl-undecanal(1.1%), 2-dodecanone (1.1%), 2-nonanol (1.1%), elemol(1.1%), other components were present in amount less than 1% (Table 1).

The composition of the oil of *R. graveolens* L. from aerial parts are presented in Table 1. The chemical class distribution of the oil components is also reported in Table 2. Substantially higher amounts of oxygenated compounds and lower amounts of monoterpenoids illustrated in essential oil of *R. graveolens* L.

Monoterpenoids are less valuable than oxygenated Compounds in terms of their contribution to the fragrance of the essential oil. [8]. Literature survey on essential oil revealed that the predominate constituents of *Ruta graveolens* oils mainly consist of hydrocarbon ketones. Similar to our investigation, Undecan-2-one and nonan-2-one were found as major components in other studied on essential oil of *Ruta graveolens* [6,9-10].

CONCLUSION

We have attempted to characterize the quality of essential oil of *R. graveolens* L. Analysis of the essential oil chemical composition enables us to check that the product in natural, without the addition of any extra components. This study represents first step in general approach that aims to provide a better knowledge of *R. graveolens* L. growing in Iran.

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