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CHEMICAL ANALYSIS OF ESSENTIAL OIL OF *RUTA CHALEPENSIS* L. BY GC-MS ANALYSIS

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ABSTRACT

Ruta Chalepensis L. leaf essential oils were hydrodistillated and analyzed by GC-MS for their chemical compositions. Ten compounds were identified from the plant leaves, with 2-undecanone (40.69%), butanoic acid3-oxo- ethyl ester (23.5%) and 2-acetylcycloheptanone (17.1 %) as the three major chemical compositions. Moreover, butanoic acid 3-oxo- ethyl ester (23.50 %), 2-acetylcycloheptanone (17.10 %), acetic acid-sec-octyl ester (2.17 %), and phenol 4 - (1, 1, 3, 3-tetramethylbutyl) (3.10%) were reported for the first time in the essential oil of R. chalepensis L. leaves collected from Mekelle, Ethiopia.

Keywords – Ruta chalepensis L., Leaves, Essential oil, GC-MS, Secondary metabolites.

1. INTRODUCTION

Natural products are basically secondary metabolites, produced by organisms in response to external stimuli such as infections, nutritional changes and competition[1]. They are produced by plants, fungi, bacteria, insects and animals. Approximately one third of the world top selling drugs are natural products or their derivatives. Nowadays, 40% of the modern drugs are of natural origin[2,3]. In 1998, the WHO estimated that 80% of the people living in developing countries almost exclusively use traditional medicine. Moreover in Ethiopia, 80% of the people depend on medicinal plants[4,5].

R. chalepensis L. (family *Rutaceae*) is native of Africa, South America and Asian countries. It is growing wild and is widely distributed in tropical and temperature regions. *R. chalepensis* L is commonly used in folk medicine to treat diseases like upper bronchitis, toothache, earache, stomachache, rheumatic fever, diarrhoea, headache, ophthalmic, skin diseases, pneumonia, and also as a treatment for cough, fever, and conjunctivitis. The essential oil of *R. chalepensis* L exihibits considerable antibacterial and antifungal activities. The aim of the present study was to analyse the essential oil components of *R. chalepensis* L. by GC-MS and to compare the active principles present with already reported in literature[6-30].

2. EXPERIMENTAL

2.1 Plant material

The ariel parts of plant *R. chalepensis* L. were collected during the month of march 2017 around Hyderabad, India. The plant material was identified by the authors and its herbarium sheet was deposited at the post graduate laboratory of the department of chemistry.

2.2 Chemical reagents

All chemicals used in this study were of analytical grade and obtained from sigma Co. (St. Louis, Mo, USA)

2.3 Extraction of essential oils

The shade dried aerial parts of *R. chalepensis* L. plant collected and one kilogram of it was subjected to hydro distillation in Clevenger apparatus for 3Hrs. The essential oil was seprated from the aqueous layer using a 100mL capacity sepratory funnel. The collected essential oil was dried over anhydrous sodium sulphate and filtered essential oil was stored at 4^{o}C in dark brown 5mL capacity sample vial until analysis. The yield of the oil was found to be 0.44%(V/W) in relation to the dry weight.

2.4 GC and GC-MS analysis

Essential oil samples of *R. chalepensis* L. with an injection volume of 2 µl were injected into Schimadzu GC 2010 HP 5890 gas chromatography equipped with a flame ionisation detector (FID) and a 30 m x 0.25 mm column of 0.1 mm film thickness of 100% dimethylpolysiloxane was used for the study. Operating conditions were: oven temperature program from 60 °C (for 5 min) to 200 °C at 10 °C/min and the final temperature kept for 5 min. Helium was used as carrier gas at constant flow of 1.04 ml/min through the column. The identification of the essential oil constituents was done based on a comparison of their retention times to *n*-alkanes, compared to published data and spectra of authentic compounds.

The GC - MS analysis of RCEO was done by injecting 1.2 µl sample of *R. chalepen-sis* L. oil in the system. The GC (HP 5890) condition was as follows: Capillary column of 15 m 25 x 0.25 mm I.D, 0.5 µm film thickness (RTX-5MS) was used. The oven temperature was programmed from an initial temperature of 75 °C (for 1 min), rising to 300 °C at 15 °C/min, and held isothermal for 10 min. Quantitative data were calculated using peak area ratios. Helium was used as carrier gas at constant flow of 1.2 ml/min through the column with an injection temperature of 250 ^{o}C. Mass spectrophotometer was operated with ionization of 70eV, with an electronic ionization mode; ion source temperature was 250 °C. Mass unit were monitored from 30 to 400 m/z. The composition of each constituent was reported as a relative percentage of the total peak area.

3. RESULTS AND DISCUSSION

The GC and GC-MS results showed that ten compounds were identified. The total identified oil compositions represent 94.43 % of the total detected constituents. Some of the identified compounds (such as: 2-decanone, 2-undecanone, 2-dodecanone, and 2-tridecanone) of the isolated essential oils were agreement with those reported previously. However, these components were present in different amount. The reason of this variation might be due to climatic, seasonal, geographic conditions, harvest period, and extraction technique[10]. Among functional groups of the major chemical compositions ketones were the major constituents, which represent 65.49 % of the total identified constituents. In additions, 46 esters account 25.67 %, whereas phenols found only in small amounts i.e. 3.1 % of total detected compounds to the best of our knowledge, among the total identified chemical compositions of *R. chalepensis* L. leaves, four of them were reported for the first time. These are butanoic acid 3-oxo- ethyl ester, 2-acetylcycloheptanone, acetic acid-sec-octyl ester**,** and phenol, 4 - (1, 1, 3, 3-tetramethylbutyl). Extraction and analysis of the composition of *R. chalepensis* essential oils, showed qualitative and quantitative differences based on the duration of extraction, the part of the plant and the drying effect.

Table-1: Results obtained using GC-MS

Peak No	RT	Compounds Identified	Percentage composition
1	3.74	2-decanone	3.90
2	4.16	Butanoic acid, 3-oxo-, ethyl ester	24.50
3	4.74	2-undecanone	39.69
4	4.83	unknown	2.57
5	5.04	Acetic acid-sec-octyl ester	2.17
6	5.32	2-dodecanone	2.10
7	5.58	unknown	1.20
8	5.91	2-acetylcycloheptanone	18.10
9	6.42	2-tridecanone	1.50
10	8.84	Phenol, 4 - (1, 1, 3, 3 - tetramethylbutyl)	3.10
Total percentage composition			**98.72 %**

4. CONCLUSION

There is a small variation in the yield of hydrodistillation of *R. chalepensis* L. leaves essential oils. This might have been due to the reason that the seasonal conditions can influence the regulation of the biosynthesis of essential oils. Quantitative determination of *R. chalepensis* L leaves essential oils using GC-MS analysis revealed that ketones are the main class of constituents which accounts 65.49 % of total compositions. From total identified compounds 2-undecanone **(**39.69 %), butanoic acid 3-oxo-ethyl ester (24.50 %) and 2-acetylcycloheptanone (18.1 %) were the three major compounds. However, butanoic acid 3-oxo- ethyl ester (24.50 %), 2-acetylcycloheptanone (18.10 %), acetic acid-sec-octyl ester (2.17 %), and phenol, 4 - (1, 1, 3, 3-tetramthylbutyl) (3.10 %) were reported for the first time from the essential oil of *R. chalepensis* L.

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