

## GC/MS Analysis of the Volatile Constituents of *Artemisia monosperma*

TARIQ R. SOBAHI and MAMDOUH ABDEL-MOGIB  
*Department of Chemistry, Faculty of Science,  
King Abdulaziz University, Jeddah, Saudi Arabia*

**ABSTRACT.** The volatile constituents of *Artemisia monosperma* Del. from Riyadh area, Saudi Arabia, using GC/MS are described. Twenty-five compounds, mainly sesquiterpenes, have been identified. The chemical findings ascertained that *A. monosperma* exhibits ecological variability in its chemical composition.

### Introduction

Many medicinal uses have been reported for the plants of the genus *Artemisia*<sup>[1]</sup> (Compositae). Saleh<sup>[2]</sup> reported the insecticidal activity of *A. monosperma* and has attributed this activity to an acetylenic compound, which was incorrectly assigned as 3-methyl-3-phenyl-1,4-pentadiyne, but it was later corrected as 2,4-hexadiynylbenzene<sup>[3]</sup>.

*A. monosperma* was investigated previously for flavonoids<sup>[3-6]</sup>, acetylenes<sup>[2,3,7]</sup>, *p*-hydroxyacetophenone derivatives<sup>[3,7-10]</sup>, coumarins<sup>[9]</sup>, *p*-coumaric acid derivatives<sup>[3]</sup>, tetrahydrofuran-type terpenoids derived from davanone<sup>[11]</sup>, in addition to cycloartenol,  $\beta$ -sitosterol and stigmasterol<sup>[11]</sup>. Comparing the chemical constituents of aerial parts of two specimens of *A. monosperma*, collected from Saint Katherine, South Sinai, Egypt<sup>[11]</sup>, and from Western Desert, Egypt<sup>[3]</sup>, using the same method of processing, revealed that they are completely different. In this article, we have investigated the chemical constituents of the aerial parts of a third specimen of *A. monosperma*, collected from Riyadh area, Saudi Arabia. The results confirm the variability in the chemical constituents of *A. monosperma* according to locality accessions.

## Experimental

GC/MS spectra were taken on QP-7000 Shimadzu, with a fused silica capillary column (30 m × 0.25 mm ID), film (5% phenyl, 95% methylsilicon) thickness 0.25 μ, and the output is an IBM computer with software class 5000 and NIST library for comparison.

### *The Plant Material*

The aerial parts of *A. monosperma* Del. In the flowering stage (1000 g) are collected from Riyadh area in April 1999 and identified by Prof. Dr. A. Faied, Botany Dept., Faculty of Science, King Abdulaziz University. A specimen was deposited in the Herbarium of Botany Dept., Faculty of Science, King Abdulaziz University.

### *Processing of Plant Material*

The air-dried, ground aerial parts (1000 g) were extracted at room temperature by soaking in a mixture 1:1:1 of methanol/ether/pet. ether 40-60° for 24 h. The crude extract (84 g) was defatted by dissolving in cold MeOH (150 ml) and standing in the fridge freezer for overnight, then, quick filtration and evaporation gave the defatted extract (38 g). The defatted extract was fractionated over silica gel (160 g) CC (100 cm length × 4 cm inner diameter) using stepwise elution into six fractions. Am3a (15.8%) and Am3b (10.5%) using the eluent mixture pet. ether/ether 3:1; Am4a (18.4%) and Am4b (14.5%) using pet. ether/ether 1:1; Am5 (11.8%) using ether and Am6 (10.3%) using ether/MeOH 9:1.

## Results and Discussion

Fractions described above were found, by <sup>1</sup>H-NMR to contain complicated mixtures of weakly polar components. Therefore, GC/MS technique was subsequently used to analyze the constituents of these fractions. Twenty five compounds were identified, based upon the comparison of the mass spectrum given by the computer from the NIST library with the actual spectrum of each component with the standard spectrum from NIST library. After that the structure was further ascertained by comparing their mass spectral data with those available in Adams<sup>[12]</sup> or of the corresponding compound from the literature.

Fraction Am3a gave β-citronellyl propanoate<sup>[12]</sup> (21.5%, R<sub>t</sub> 29.70 min), geraniol<sup>[12]</sup> (12.2%, R<sub>t</sub> 30.61 min), γ-cadinene<sup>[12]</sup> (15.8%, R<sub>t</sub> 31.64 min), 10(14)-aromadendrene<sup>[12]</sup> (13.1%, R<sub>t</sub> 31.98 min), germacrene D<sup>[12]</sup> (10.2%, R<sub>t</sub> 32.25 min) and palmitic acid<sup>[13]</sup> (9.4%, R<sub>t</sub> 38.67 min).

Fraction Am3b afforded β-citronellyl propanoate (18.3%, R<sub>t</sub> 29.70 min), spathulenol<sup>[12]</sup> (4.6%, R<sub>t</sub> 30.10 min), caryophyllene oxide<sup>[12]</sup> (6.6%, R<sub>t</sub> 30.22 min),

linalool acetate<sup>[12]</sup> (6.2%,  $R_t$  30.64 min), 1  $\beta$ -hydroxyallo-aromadendrene<sup>[14]</sup> (4.8%,  $R_t$  30.94 min), 4(15)-eudesmen-6-ol<sup>[14]</sup> (3.2%,  $R_t$  31.26 min), methyl ferulate<sup>[15]</sup> (6.5%,  $R_t$  31.64 min),  $\beta$ -cedrene<sup>[12]</sup> (7.6,  $R_t$  32.01 min) and  $\gamma$ -elemene<sup>[12]</sup> (3.1%,  $R_t$  32.28 min).

Fraction Am4a gave *p*-hydroxyacetophenone<sup>[16]</sup> (17.9%,  $R_t$  26.17 min), spathulenol (5.5%,  $R_t$  30.10 min), tremetone<sup>[3]</sup> (5.0%,  $R_t$  33.80 min), 15-hydroxy- $\alpha$ -muurolene<sup>[12]</sup> (6.5%,  $R_t$  34.83 min), 14-hydroxy- $\alpha$ -muurolene<sup>[14]</sup> (6.6%,  $R_t$  35.97 min), 4(15)-eudesmen-1,6-diol<sup>[14]</sup> (10.2%,  $R_t$  37.25 min) and 8,11,13-abietatriene<sup>[12]</sup> (20.5%,  $R_t$  49.82 min).

Fraction Am4b afforded *p*-hydroxyacetophenone (26.7%,  $R_t$  26.17 min), spathulenol (1.5%,  $R_t$  30.10 min), tremetone (4.9%,  $R_t$  33.80 min),  $\beta$ -patchoulene<sup>[12]</sup> (3.5,  $R_t$  34.58 min), trans calamenene<sup>[12]</sup> (1.4%,  $R_t$  34.80 min), cis calamenene<sup>[12]</sup> (2.0%,  $R_t$  35.64 min), 14-hydroxy- $\alpha$ -muurolene (10.1%,  $R_t$  35.97), 4(15)-eudesmen-1,6-diol (2.1%,  $R_t$  37.25 min), licochalcone B<sup>[17]</sup> (11.9%,  $R_t$  48.64 min) and 8,11,13-abietatriene (9.9%,  $R_t$  49.82 min).

Fraction Am5a gave 10,11-dihydro-10-hydroxy-tremetone<sup>[15]</sup> (12%,  $R_t$  42.29 min).

Comparing the chemical findings in the present work with those obtained previously on the same species from other two localities<sup>[3,11]</sup> revealed that, chemical constituents of *A. monosperma* are sensitive to the locality variation. However, the *p*-hydroxyacetophenone derivative tremetone was identified from the specimen of Western Desert, Egypt<sup>[3]</sup>, together with other seven *p*-hydroxyacetophenone derivatives. The specimen of Western Desert seems to be more aromatic and that of Riyadh area is rich in volatile constituents, while that of Saint Katherine<sup>[11]</sup> is the poorest one in chemical constituents, which were found to be tetrahydrofuran-type terpenoids.

### References

- [1] Boulos, L., *Medicinal Plants of North Africa*, Reference Publication, Inc., p. 54 (1983).
- [2] Saleh, M.A., *Phytochemistry*, **23**: 2497 (1984).
- [3] Abdel-Mogib, M., Dawidar, A.M., Metwally, M.A. and Abou-Elzahab, M., *Phytochemistry*, **29**: 2728 (1990).
- [4] Saleh, N.A.M., El-Negoumy, S.I., Abd-Alla, M.F., Abou-Zaid, M.M., Dellamonica, G. and Chopin, J., *Phytochemistry*, **24**: 201 (1985).
- [5] Saleh, N.A.M., EL-Negoumy, S.I. and Abou-Zaid, M.M., *Phytochemistry*, **26**: 3059 (1987).
- [6] Khafagy, S.M., El-Ghazouly, M.G. and Metwally, A.M., *Pharmazie*, **34**: 748 (1979).
- [7] Bohlmann, F. and Ehlers, D., *Phytochemistry*, **16**: 1450 (1977).
- [8] Omar, A.A., El-Ghazouly, M.G., Bohlmann, F. and Zdero, C., *Leibigs Ann. Chem.*, 1451 (1983).

- [9] **Hammouda, F., Rizk, A.M., Ismail, S.I. and Hassan, N.M.,** *Symp. Pap.*, **24**: 417 (1978).
- [10] **Khafagy, S., El-Ghazouly, M. and Metwally, A.M.,** *Pharmazie*, **34**: 11 (1979).
- [11] **Abdel-Mogib, M.,** *Proc. CCRD* (1994), *Fac. Sci., Mansoura Univ.*, 1N/1 (1994).
- [12] **Adams, R.P.,** *Identification of Essential Oil Components by GC/MS*, Allured Publishing Corporation, Carol Stream, Illinois, USA (1995).
- [13] **Bailey, A.V. and Pittman, A.,** *J. Am. Oil Chem. Soc.*, **48**: 775 (1971).
- [14] *Dictionary of Terpenoids*, Vol. **1**, J.D. Connolly & R.A. Hill, Chapman & Hall, London (1991), item No. Sq-02202.
- [15] *Dictionary of Organic Compound*, 5th Edn., Chapman & Hall, New York (1982), item No. H-02226.
- [16] **Schliemann, W.,** *Pharmazie*, **41**: 138 (1986).
- [17] **Saitoh, T.,** *Tetrahedron Lett.*, 4461 (1975).

## تحليل المكونات المتطايرة للشيخ « أرتيميا مونوسبيرما » GC/MS

طارق رشاد سبحي و ممدوح عبد المجيب

قسم الكيمياء ، كلية العلوم ، جامعة الملك عبد العزيز

جدة - المملكة العربية السعودية

المستخلص . تم جمع نبات الشيخ « أرتيميا مونوسبيرما » من منطقة الرياض بالمملكة العربية السعودية ، وفحصت المكونات الطيارة باستخدام تقنية GC/MS . نتج عن البحث تعريف خمس وعشرين مركباً ، معظمها من السسكوي تربينات . وقد جاءت النتائج مؤكدة أن هذا النبات حساس للتغيرات في موقع الجمع .