

## Determination of Chemical Constituents of Leaf and Stem Essential Oils of *Artemisia monosperma* from Central Saudi Arabia

Merajuddin Khan<sup>a</sup>, Ahmad A. Mousa<sup>a</sup>, Kodakandla V. Syamasundar<sup>b</sup> and Hamad Z. Alkhathlan<sup>a,\*</sup>

<sup>a</sup>Department of Chemistry, College of Science, King Saud University, P.O.Box 2455, Riyadh - 11451, Saudi Arabia

<sup>b</sup>CSIR-Central Institute of Medicinal and Aromatic Plants, Research Centre, Boduppal, Hyderabad-500092, India

khathlan@ksu.edu.sa

Received: April 20<sup>th</sup>, 2012; Accepted: June 9<sup>th</sup>, 2012

The leaf and stem essential oils of *Artemisia monosperma* from the desert region of central Saudi Arabia were analysed by gas chromatography-based techniques (GC-FID, GC-MS, Co-GC, LRI determination, database and literature search) using polar as well as non-polar columns, which resulted in the identification of 130 components, of which 81 were common to both oils. In the leaf oil 120 compounds were identified, while 91 were identified in the stem oil accounting for 98.4% and 99.7% of the oil composition, respectively. The major constituents of the leaf oil were  $\beta$ -pinene (50.3%),  $\alpha$ -terpinolene (10.0%), limonene (5.4%) and  $\alpha$ -pinene (4.6%), while the major constituents of the stem oil were  $\beta$ -pinene (36.7%),  $\alpha$ -terpinolene (6.4%), limonene (4.8%),  $\beta$ -maaliene (3.7%), shyobunone (3.2%) and  $\alpha$ -pinene (3.1%). The two oils showed an important qualitative similarity. However, some specific constituents (39 in the leaf oil and 10 in the stem oil) allow differentiation of the two essential oils.

**Keywords:**  $\beta$ -Pinene, Terpinolene, Limonene, Leaves, Stem, *Artemisia monosperma*, Asteraceae.

*Artemisia* L. is a genus of small herbs and shrubs found in temperate regions throughout the northern hemisphere. It belongs to the important family Asteraceae (Compositae), one of the most numerous plant groups, which comprises about 1,000 genera and over 20,000 species. Within this family, *Artemisia* is included in the tribe Anthemideae and comprises over 500 species, which are mainly found in Asia, Europe and North America [1]. The genus is well known for producing essential oils which have wide applications in folk and modern medicine, and in the cosmetics and pharmaceutical industries [2, 3].

*A. monosperma* Del. is a bushy leafy shrub with long narrow leaves containing scattered hairs. In Saudi Arabia, it is famous, where it goes under the local name of Aader or Selikah [5a]. The flower spikes have tiny green bracts and round green bud-like flowers. It is a perennial fragrant plant which grows widely up to 1 meter in height in the Arabian deserts [4, 5b]. *A. monosperma* is also found in the desert of other Arabian countries such as Iraq, Kuwait, Egypt and Jordan [6]. In folk medicine, *A. monosperma* is reputed to have antispasmodic, anthelmintic and anti-hypertensive properties [7-9]. The leaves of the plant are used for abortion induction in folk medicine in Jordan [10]. *A. monosperma* has been reported to have medicinal applications [11-13] and possess several important biological properties, such as antioxidant [14], insecticidal [15], anti-malarial [16] and anticancer [17] activities. Various classes of bioactive phytochemicals such as coumarins [18, 19], flavanoids [11, 20-22], acetylenes [15, 23, 24], alkaloids [25], sesquiterpenes [26] and triterpenoids [20] have been reported from this plant. A volatile component, 3-methyl-3-phenyl-1,4-pentadiyne, identified from the steam distillate of the aerial parts, has been reported to possess strong insecticidal activity against house fly, cotton leaf worm and the rice weevil [15].

Although a number of reports have appeared in the literature on the medicinal applications and isolation of bioactive phytochemicals, along with the determination of an individual volatile component

from *A. monosperma* [15], detailed studies on the chemical profile of its essential oil have not yet been undertaken, except for a few short reports from the Egyptian geographical area [24, 27, 28]. Furthermore, to the best of our knowledge, a detailed investigation of the aroma volatiles of *A. monosperma* grown in Saudi Arabia has not been reported to date. This prompted us to carry out a detailed GC-MS analysis of the leaf and stem essential oils of *A. monosperma* growing wild in the desert of central Saudi Arabia.

Hydrodistillation of leaves and stems of *A. monosperma* gave light yellowish colored oils with high yields of 1.3 and 0.3%, v/w, on a fresh weight basis, respectively. Both oils were analyzed by GC-MS and GC-FID using polar and non-polar columns, which enabled the identification of 130 constituents in both oils, of which 81 were found to be common to the two oils. In the leaf oil 120 compounds were identified and 91 in the stem oil accounting for 98.4% and 99.7% of the total, respectively. The identified compounds and their relative percentages are listed in Table 1 according to their elution order from a non-polar column (HP-5MS).

Both oils were dominated by monoterpene hydrocarbons (leaf oil: 77.9%; stem oil: 56.6%). Oxygenated sesquiterpenes (leaf oil: 7.5%; stem oil: 17.5%), oxygenated monoterpenes (leaf oil: 7.1%; stem oil: 7.8%) and sesquiterpenes (leaf oil: 3.4%; stem oil: 10.7%) were present in lesser amounts in both oils. Aromatic compounds (leaf oil: 1.9%; stem oil: 2.9%) and oxygenated aliphatic hydrocarbons (leaf oil: 0.6%; stem oil: 3.5%) were present in low concentrations in both oils. On the other hand, aliphatic hydrocarbons were only found in the stem oil in minute concentration; however, they were not detected in the leaf oil. The leaf and stem essential oils showed important qualitative similarities, since 81 components were present, in appreciable amounts, in both the leaf and stem oils, although they differed significantly with respect to their percentage {for example,  $\beta$ -pinene (9; 50.3%; 36.7%),  $\alpha$ -terpinolene (22; 10.0%; 6.4%), limonene (17; 5.4%; 4.8%) and  $\alpha$ -pinene (4; 4.6%; 3.1%)}. However, some