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COMPARISON OF THE COMPONENTS OF THE ESSENTIAL OILS FROM LEAVES AND FRUITS OF *Grammosciadium platycarpum*

B. Nickavar,[1,2] M. Kamalinejad,[1] and S. Mohandesi[3]

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The composition of the hydrodistilled essential oils obtained from dried leaves and fruits of Grammosciadium platycarpum *Boiss. & Hausskn. were determined by GC and GC/MS. Twenty-five compounds (87.0%) and sixteen constituents (96.2%) were identified in the leaf and fruit oils, respectively. Linalool (26.1 and 53.9%), (*E,E*)-α-farnesene (24.1 and 20.4%) and (Z)-β-santalol (10.6 and 10.9%) were the major components in the leaf and fruit oils.*

Key words: *Grammosciadium platycarpum*, Umbelliferae, essential oil, chemical composition.

The genus *Grammosciadium* DC., belonging to the Umbelliferae family, is represented by about three herbaceous species in the flora of Iran (*G. platycarpum* Boiss. & Hausskn., *G. pterocarpum* Boiss., *G. scabridum* Boiss. & Hausskn.) that grow naturally in the mountainous regions of the country. *G. platycarpum*, Sheved-e Kohi in Farsi, is one of these species which is a perennial plant with a very strong fragrance [1, 2].

A review of the chemical constituents of *Grammosciadium* showed that the phytochemical composition of the genus has been addressed by only two studies in the past. In 2005, Sonboli *et al.* reported that the essential oil from the whole aerial parts of *G. platycarpum* consisted mainly of linalool (79.0–81.8%) and limonene (5.8–10.0%) [3]. Also, Sonboli and co-workers analyzed the volatile constituents of the aerial parts of *G. scabridum* in 2005. According to the study, the oil was characterized by high amounts of γ-terpinene (73.5%), *p*-cymene (14.2%), and (*E*)-β-farnesene (5.3%) [4].

The aromatic properties of the different parts of *G. platycarpum* led us to investigate the essential oils of leaves and fruits of the plant and describe the detailed chemical composition of them in order to complete the chemical characterization of the species.

The essential oil yields obtained from the hydrodistillation of the leaves and fruits of *G. platycarpum* were 0.5 and 2%, respectively. The chemical compositions of the oils were analyzed by GC and GC/MS. The identified compounds represented 87.0 and 96.2% of the total constituents, respectively. The oils components and their retention indices and percentage composition are given in Table 1. From Table 1, it is evident that the compositions of the oils are different qualitatively and quantitatively. As indicated in Table 2, mono- and sesquiterpenoid constituents are the main compounds in the oils. However, the amounts of those show remarkable differences both in the leaf oil (29.6 and 56.6%, respectively) and in the fruit oil (59.8 and 36.4%, respectively). Regarding the quantitative terpenoid composition, higher amounts of monoterpenoids in comparison with sesquiterpenoids are present in the essential oil of fruit, while in the leaf essential oil, sesquiterpenoids are the main group. Both oils revealed linalool [26.1% (leaves), 53.9% (fruits)], (*E*,*E*)-α-farnesene [24.1% (leaves), 20.4% (fruits)] and (*Z*)-β-santalol [10.6% (leaves), 10.9% (fruits)] as the main constituents. (*Z*)-Nerolidol (10.6%) was another major component in the leaf oil but it was not detected in the fruit oil. Overall, GC and GC/MS analysis of the leaf and fruit oils of *G. platycarpum* shows that the oils are rich in oxygenated terpenoids (57.4 and 69.0%, respectively).

1) Department of Pharmacognosy, School of Pharmacy, Shaheed Beheshti University of Medical Sciences, P. O. Box: 14155-6153, Tehran, Iran, fax +98 21 88795008, e-mail: bnickavar@yahoo.com; 2) Pharmaceutical Sciences Research Center, Shaheed Beheshti University of Medical Sciences, P. O. Box: 14155-3817, Tehran, Iran; 3) School of Pharmacy, Azad Islamic University, Tehran, Iran. Published in Khimiya Prirodnykh Soedinenii, No. 6, pp. 559-560, November-December, 2006. Original article submitted November 7, 2005.

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TABLE 1. Chemical Composition of the Fruits and Leaves Oils of *G. platycarpum*

Compounds[a]	RI	Fruits, %	Leaves, %	Compounds[a]	RI	Fruits, %	Leaves, %
β-Pinene	963	0.9	0.5	β-Elemene	1394	0.1	0.2
2-Octanol	990	-	0.5	(*E*)-Caryophyllene	1425	0.3	0.5
p-Cymene	1013	-	Tr.[b]	β-Gurjunene	1443	Tr.	-
Limonene	1018	4.5	1.9	α-Guaiene	1452	-	0.2
(*Z*)-β-Ocimene	1036	-	0.2	(*E*)-β-Farnesene	1464	0.1	0.3
(*E*)-β-Ocimene	1047	-	0.2	β-Chamigrene	1474	Tr.	-
γ-Terpinene	1054	0.4	-	(*E*,*E*)-α-Farnesene	1516	20.4	24.1
Linalool	1112	53.9	26.1	(*Z*)-Nerolidol	1535	-	10.6
Camphor	1142	0.1	0.4	(*E*)-Nerolidol	1552	-	0.5
Dihydrocarveol	1190	-	0.1	Spathulenol	1607	2.5	7.0
n-Decanal	1200	-	0.1	(*Z*)-α-Santalol	1652	-	0.6
(*Z*)-Carveol	1260	-	0.2	(*Z*)-β-Santalol	1694	10.9	10.6
n-Decanol	1270	-	0.2	(*Z*)-α-Bergamotol acetate	1790	1.6	1.3
Bicycloelemene	1326	Tr.	Tr.	Total		96.2	87.0
δ-Elemene	1337	0.5	0.7				

[a]Compounds are listed in order of their elution from a DB-5 column.
[b]Tr.: (trace compound) less than 0.1%.

TABLE 2. Percentage Classes of Compounds in Fruits and Leaves Oils of *G. platycarpum*

Group of compounds	Fruits, %	Leaves, %
Hydrocarbon monoterpenes	5.8	2.8
Oxygenated monoterpenoids		
alcohols	53.9	26.4
ketones	0.1	0.4
Total monoterpenoids	59.8	29.6
Hydrocarbon sesquiterpenes	21.4	26.0
Oxygenated sesquiterpenoids		
alcohols	13.4	29.3
esters	1.6	1.3
Total sesquiterpenoids	36.4	56.6
Miscellaneous	-	0.8
Total	96.2	87.0

There are some quantitative and qualitative differences between this study and the previous investigation on the essential oil of *G. platycarpum*. They could be due to differences in the examined plant materials, climatic and geographical conditions (difference of period and geographic area of collection), the existence of different varieties of chemotypes of *G. platycarpum*, and/or all of them.

EXPERIMENTAL

Plant Materials. The leaves and fruits of *G. platycarpum* were collected from Saveh, Markazi province, Iran, in July 2004. Voucher specimens were deposited in the Herbarium of the Department of Pharmacognosy, School of Pharmacy, Shaheed Beheshti University of Medical Sciences, Tehran, Iran.

Isolation of the Oils. The essential oils of the air dried leaves (200 g) and fruits (50 g) were obtained separately by hydrodistillation for 3 h using a Clevenger-type apparatus. The oils were dried over anhydrous sodium sulfate and stored under N_2 in a sealed vial until required.

Analysis of the Oils. Each sample was analyzed by GC/FID and GC/MS. GC analyses were carried out on a HP-6890 gas chromatograph equipped with a FID and a DB-5 capillary column (30 m × 0.25 mm; 0.25 μm film thickness). The oven temperature was held at 50°C for 0.5 min, then programmed at 2.5°C/min to 265°C. Other operating conditions were as follows: carrier gas, N_2 with a flow rate of 1.5 mL/min; injector temperature, 250°C; detector temperature, 300°C; split ratio, 1:10. GC/MS analyses were performed on a Thermoquest 2000 GC coupled with a Thermofinnigan Mass system and a DB-5 capillary column (30 m × 0.25 mm; 0.25 μm film thickness). The operating conditions were the same as described above, but the carrier gas was He. Mass spectra were taken at 70 eV. Mass range was from *m/z* 35–375 amu.

Compounds were identified by comparing their mass spectra to those of the Wiley275.L library and/or with the published mass spectra and also by comparison of their GC retention indices with those reported in the literature [5, 6]. Retention indices were calculated using the retention times of *n*-alkanes. The percentage compositions were obtained by electronic integration of GC peaks areas without using correction factors.

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