DOI 10.1007/s10600-015-1469-3
Chemistry of Natural Compounds, Vol. 51, No. 5, September, 2015

ESSENTIAL OIL COMPOSITION OF *Tordylium elegans*

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The genus *Tordylium* L. (Umbelliferae) is represented by 16 species, including six endemic species in Turkey [1, 2]. *Tordylium elegans* (Boiss. & Balansa) Alava & Hub.-Mor. (Syn.: *Ainsworthia elegans* Boiss. & Balansa), the endemic species, grows in rocky places, fields, and roadsides as an annual plant [1]. There are only a few phytochemical and biological activity studies on some *Tordylium* species. Essential oil studies on *Tordylium* species are quite scarce [3–9]. Thus, in the present study, essential oils from crushed fruits of *Tordylium elegans* collected from different localities were distilled using an Eppendorf Microdistiller®. The oils were analyzed by GC-FID and GC/MS. The list of compounds identified in the microdistilled oils of *Tordylium elegans* with their relative percentages, retention indices, and percentage amounts of compound classes are given in Table 1.

The aim of this study was to determine the essential oil composition of *Tordylium elegans* as a part of our ongoing research on *Tordylium* species. To date, the essential oils of *T. apulum*, *T. pestalozzae*, *T. pustulosum*, *T. lanatum*, *T. trachycarpum*, *T. hasselquistiae*, *T. ketenoglui*, *T. syriacum*, and *Tordylium aegyptiacum* growing in Turkey have been analyzed by our group, and their constituents have been determined [3, 7–9].

In this study, octyl hexanoate (72.8% in sample A and 93.1% in sample B) was found to be the main constituent of the samples collected from different places (Table 1).

Therefore, this is the first report on the essential oil of *T. elegans* as an endemic species. Octanol and octyl esters appear to be the predominant components of the oils of *Tordylium* species. However, different environments may affect the amounts of the constituents in the essential oils.

Plant Material. The plant materials were collected from two locations in Turkey. Dry fruits of *Tordylium elegans* were collected on June 22, 2007 from Adana-Pozanti-Gulek, Kesik Village (A), and on June 07, 2005 from Kahramanmaras, Ahir Mountain, Tomek Province (B). Voucher specimens are deposited at Duman′s collection (MV & HD 9991 for A) and Duran′s collection (AD 6950 for B).

Isolation of the Essential Oils. Microdistillation (MD). Essential oils were extracted from crushed fruits of *Tordylium elegans* using an Eppendorf Microdistiller®. The crushed fruits were placed in a sample vial together with 10 mL of water. Sodium chloride (2 g) and water (0.5 mL) were placed in the collecting vial. *n*-Hexane (300 μL) was added to the collecting vial to trap volatile compounds. The apparatus was operated according to the "Essential Oils Programme." The sample vials were heated to 100°C at a rate of 20°C/min, kept at 100°C for 15 min, then heated to 112°C at a rate of 20°C/min and kept at 112°C for 35 min. Finally, the samples were subjected to a post-run for 2 min under the same conditions. The collecting vials, placed in a cooler, were kept at –1°C during distillation. After completion of the distillation, the organic layer in the collection vial was separated from the water phase and subjected to GC and GC/MS.

GC and GC/MS. The oils were analyzed by capillary GC and GC/MS using an Agilent GC-MSD system (Agilent Technologies Inc., Santa Clara, CA).

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 0009-3130/15/5105-0980 ©2015 Springer Science+Business Media New York

TABLE 1. Composition of the Essential Oils of *Tordylium elegans*, %

Compound	RRI	A	B	Compound	RRI	A	B
Limonene	1203	–	0.1	**Octyl hexanoate**	1829	**72.8**	**93.1**
Octanol	1562	**24.0**	1.1	Caryophyllene oxide	2008	–	0.2
β-Caryophyllene	1583	0.3	0.1	Octyl octanoate	2020	1.3	2.3
Hexyl hexanoate	1589	0.1	0.1	Spathulenol	2144	–	0.1
Octyl butyrate	1596	0.4	0.2	Thymol	2198	–	0.5
1-Decanol	1766	0.2	–				

RRI: Relative retention indices calculated against *n*-alkanes, percentage amounts calculated from FID data.
A: June 22, 2007 from Adana-Pozanti-Gulek, KesikVillage; B: June 07, 2005 from Kahramanmaras, Ahir Mountain, Tomek Province.

GC/MS. The GC/MS analysis was carried out with an Agilent 5975 GC-MSD system. Innowax FSC column (60 m × 0.25 mm, 0.25 μm film thickness) was used with helium as carrier gas (0.8 mL/min). The GC oven temperature was kept at 60°C for 10 min and programmed to 220°C at a rate of 4°C/min, and kept constant at 220°C for 10 min and then programmed to 240°C at a rate of 1°C/min using the splitless mode. The injector temperature was at 250°C. MS were taken at 70 eV. Mass range was from *m/z* 35 to 450.

GC. The GC analysis was carried out using an Agilent 6890N GC system. In order to obtain the same elution order with GC/MS, simultaneous injection was done by using the same column and appropriate operational conditions. The FID temperature was 300°C.

The components of the essential oils were identified by comparison of their mass spectra with those in the Baser Library of Essential Oil Constituents, Wiley GC/MS Library, Adams Library, and MassFinder Library and confirmed by comparison of their retention indices. Alkanes were used as reference points in the calculation of relative retention indices (RRI). Relative percentage amounts of the separated compounds were calculated from FID chromatograms. The results of analysis are shown in Table 1.

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