Chemical composition of the essential oil of *Eremostachys Laevigata* bung

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ABSTRACT

Essential oil of *Eremostachys laevigata* Bung**.** (Lamiaceae) was obtained by hydrodistillation of the aerial parts of the plant and analyzed by GC/MS. Forty-two components representing 92.6% of the oil constituents were identified. The major components of the oil were dodecanal(13.4%),germacrene-D (11.5%), β- caryophyllene (10.7%) and caryophyllene oxide (7.2%).

Keywords: Essential oil, *Eremostachys laevigata*, Germacrene-D**,** β-caryophyllene**,** Caryophyllene oxide, Dodecanal**.**

INTRODUCTION

The genus *Eremostachys*, which belongs to Lamiaceae family, consists of about 60 species that are mainly present in South Western Asia (1). In many regions of Iran 15 species of *Eremostachys* grow wildly, of them *E. pulvinaris, E. codonocalyx, E. hyoscyamoides, E. azerbaijaanica* and *E. adenantha* are endemic (2). Previous phytochemical investigations on a few species of the genus of *Eremostachys* have revealed the presence of flavonoids, e.g. luteolin and chrysoeriol glycosides (3) of which monoterpen glycosides of *Eremostachys fetissovii* and a furanolabdane diterpene glycoside from *Eremostachys glabra* have been identified (4,5). Also structure and biological activity of two ferulic acide derivatives from *Eremostachys glabra* (6) and 3 phenylethanoid glycosides as antioxidant from rhizomes of *Eremostachys pulvinaris* has been reported (7).

E.laevigata Bung. which is an everlasting herb is widely distributed in Zagroos mountaines in West of Iran (8). This plant is traditionally used in Lorestan province for relief of the pain caused by insects or reptiles bites and it is also used in industry for dyeing.

To the best of our knowledge, *E.laevigata* Bung. has not been the subject of any investigation and this paper is the first phytochemical study of this plant.

MATERIALS AND METHODS

Plant material

The aerial parts of Eremostachys laevigata were collected in flowering stage in July of 2004, from 15 Km North of Khoramabad (Lorestan Province), Iran, at altitude of 1700 m. Voucher specimens (No:63029) have been deposited at the Herbarium of Research Institute of Forests and Rangelands (TARI), Tehran, Iran.

Isolation of the oil

The aerial parts of *Eremostachys laevigata* were subjected to hydrodistillation for 3hrs using a Cleavenger–type apparatus according to the British Pharmacopoeia (9). The oil was decanted and dried over anhydrous sodium sulfate.

GC analysis

GC analysis was performed on a Shimadzu 15A gas chromatograph equipped with a split / splitless injector (250˚C) and a flame ionization detector (250ºC). Nitrogen was used as a carrier gas (1 mL / min) and DB-5 (50m × 0.2 mm film thickness 0.32μ m) was used as capillary. The column temperature was kept at 60˚C for 3min and then heated to 220˚C with a 5˚C / min rate and kept constant at 220˚C for 5 min.

Relative percentage of all compounds was calculated from peak areas using a Shimadzu C-R4A chromatopac without the use of correction factors.

GC/MS analysis

GC/MS analysis was performed using a Hewlett-packard 5973 with a HP- 5MS column (30m × 0.25 mm, film thickness 0.25 μ m). The column temperature was kept at 60˚C for 3min and programmed to 220˚C at rate of 5˚C / min and kept constant at 220˚C for 5 min. The flow rate of Helium as carrier gas was 1mL /min. MS were taken at 70 eV. Identification of the constituents of each oil was performed by comparison of their mass spectra and retention indices (RI) with those reported in the literature and authentic samples (10).

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RESULTS AND DISCUSSION

The amount of oil isolated from the aerial parts of *E. laevigata* Bung. by hydrodistilation, based on dry weight was 0.1% (w/w)

Lamiaceae family in Turkey on the basis of essential oil content has been classified as rich (>2%), moderately rich (0.5-2%) and poor (<0.5%) (11). Previous studies have shown that *Eremostachys* are in general poor in oil (12). The chemical composition of oil from *Eremostachys laevigata* is presented in Table 1 and components are listed in order of their elution on DB_5 column.

As it can be seen from Table 1, the main components were dodecanal (13.4%), germacrene-D (11.5%), *β*-caryophyllene (10.7%), caryophyllene oxide (7.2%), spathulenol (4.8%) and 2–pentadecanone-6,10,14-trimethyl (3.98%). The oil of the aerial parts of *E. laevigata* was dominated by sesquiterpenes (65.3%) wherease monoterpenes and aliphatic compounds were present in lower amounts (14.2% and 11.17% respectively).

According to the obtained data, it may be concluded that the main groups of constituents in essential oil of *E. laevigata* are sesquiterpens (42.9%), carbon compounds (33.5%), oxygenated compounds (30.8%), monoterpen compounds (14.8%) and hexadecanoic acid (3.9%). Comparison of the main components in *E. laevigata* with other species demonstrated that germacrene-D is also found as the major component in the essential oil of *Phlomis persica* (32.5%), *Phlomis chorassanica* (51.5%), *Phlomis anisodonta* (65%), *Phlomis lanceolata* (47%), *Nepeta ucrainica* (39.7%), *Stachys schtschegleevii* (25.8%), *Teucrium salviastrum* (21.6%), *Marrabium cunceatum* (24.1%) (13-17). Moreover, *β*-caryophyllene is the major compound of the oil of *Teucrium sativarum* (29.3%), *Phlomis olivieri* (16.1%), *Marrabium vulgare* (11.6%), *Marrabium parviflorum* (15.6%), *Phlomis bruguieri* (11%), *Salvia nemorosa* (41.6%), *Salvia virgata* (46.6%), *Salvia aethiopis* (27.5%) (18-23). Furthermore, it is has been reported that in *Nepeta saccharata* (25.5), *Stachys laxa* (1.6%) and *Astrodaucus persicus* (15.5%) dodecanal is the main constituents of the oil (24-27).

CONCLUSION

Essential oils of aromatic plant species are used in industry in the production of soaps, perfumes and toiletries. Many of them are also used in traditional medicine for various purposes and have been screened for their potential uses as alternative remedies for treatment of many infectious diseases, as food preservatives, and have shown insecticidal and antiparasitic properties (28).

The present study indicated that dodecanal, germacrene-D and *β*-caryophyllene as the main components of the oil of *E. laevigata* which have following properties.

Dodecanal as abundant component in the oil of *E. laevigata* is one of common ingredient in perfumery and have been used in soap, detergent, beauty care and household products. The substance is partially non-toxic, and is a permitted

Table1. Composition of the aerial parts oil of *Eremostachys laevigata* Bung.

No	Compound	RI	%	No	Compound	RI	%
1	α-pinene	935	1.84	22	germacrene-D	1478	11.5
2	β-pinene	974	0.32	23	bicyclogermacrene	1488	2.3
3	myrcene	986	2.05	24	pentadecane	1500	1.6
4	limonene	1025	0.98	25	germacrene-A	1503	0.44
5	1,8-cineol	1027	1.12	26	δ-cadinene	1526	1.1
6	linalool	1099	3.23	27	spathulenol	1589	4.8
7	camphor	1143	1.4	28	caryophyllene oxide	1596	7.2
8	trans-verbenol	1144	1.4	29	hexadecane	1601	1.7
9	borneol	1166	0.52	30	heptadecane	1700	1.15
10	bornyl acetate	1285	1.33	31	octadecane	1797	1.05
11	dihydroedulan	1289	0.65	32	2-pentadecanone-6,10,14-trimethyl	1849	3.98
12	tridecane	1300	0.54	33	hexadecanol	1882	0.9
13	undecanal	1305	2.17	34	nonadecane	1900	0.63
14	α- copaene	1372	1.85	35	hexadecanoic acid	1978	0.49
15	β-bourbonene	1380	1.6	36	eicosane	2000	0.31
16	β-cubebene	1386	0.53	37	heneicosane	2100	0.13
17	β-elemene	1388	0.27	38	docosane	2200	0.15
18	tetradecane	1397	0.71	39	tricosane	2300	1.6
19	dodecanal	1407	13.4	40	pentacosane	2500	3
20	β-caryophyllene	1414	10.7	41	heptacosane	2700	0.87
21	α-humulene	1449	0.65	42	nonacosane	2900	0.47

RI: Retention indices on HP-5 capillary column

food additive (GRAS) in both U.S. and the UE (inchem) (29). *β*-Caryophyllene is a common sesquiterpene that is widely distributed in plants. It possesses anti-inflammatory and anti-carcinogenic activities, and this macrocyclic olefin and its derivatives also could play a role in plant defense (30). Also germacrene-D is well known in plant-insect interaction, giving antennal responses and showing host plant recognition effects (31).

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