

Original Article

Chemical Composition of the Essential Oil from Flowers of *Calycanthus floridus* L. var. *oblongifolius* (Nutt.) D.E. Boufford & S.A. Spongberg from Iran

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Abstract

The essential oil obtained by hydrodistillation of flowers of *Calycanthus floridus* L. var. *oblongifolius* (Nutt.) D.E. Boufford & S.A. Spongberg, planted in Sabzevar, Khorasan Province (Iran), was analyzed by GC and GC/MS. Eighteen compounds representing 90.1% of the flower oil of *Calycanthus floridus* L. var. *oblongifolius* were identified, among them 1,8-cineol (33.1%), bornyl acetate (14.1%), α -pinene (10.2%), elemol (8.2%), β -pinene (8.6%) and α -terpinyl acetate (5.8%) were the major ones. In this essential oil, oxygenated monoterpenes (57.2%) predominated over monoterpene hydrocarbons (22.7%) and sesquiterpenes (10.2%). Nonterpene hydrocarbons were not found among the identified components.

Keywords: *Calycanthus floridus* L. var. *oblongifolius*, *Calycanthus fertilis*, essential oil, GC/MS.

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INTRODUCTION

The genus *Calycanthus*, belonging to the Calycanthaceae family, includes two to four species, depending on taxonomic interpretation. Of these, two are accepted by Flora of North America [1]; details can be seen in Table 1 [2].

Table 1: Species of *Calycanthus* genus accepted by Flora of North America

o	<i>Calycanthus floridus</i> (Carolina Sweetshrub). Pennsylvania and Ohio south to Mississippi and northern Florida.
o	<i>Calycanthus floridus</i> var. <i>floridus</i> (syn. <i>C. mohrii</i>). Twigs pubescent.
o	<i>Calycanthus floridus</i> var. <i>glaucus</i> (syn. <i>C. fertilis</i>). Twigs glabrous.
o	<i>Calycanthus occidentalis</i> (California Sweetshrub). California (widespread), Washington (local, Seattle area).

Calycanthus floridus L. var. *oblongifolius* (Nutt.) D.E. Boufford & S.A. Spongberg has various synonyms: *Calycanthus fertilis* Walt., *Calycanthus nanus* Loisel, *Calycanthus floridus* L. var. *laevigatus* (Willd.) T. & G., *Calycanthus glaucus* (Willd.) and the common name, Eastern Sweetshrub. The fruits are reported to be poisonous to sheep [3]. *Calycanthus* contains calycanthine, an alkaloid similar to strychnine, which is toxic to humans and livestock [4]. The leaves, root and bark of *Calycanthus floridus* L. var. *oblongifolius* have been dried

and used as a substitute for cinnamon [5], although some caution is advised [4]. Infusions of the bark have been used to treat urinary problems [6].

In Iran, two species of the genus *calycanthus* have been planted as ornamental shrubs, namely *Calycanthus floridus* and *Calycanthus fertilis* [7].

Because of their similarity in color to red wine, both of them are called “wine flower” in Persian.

EXPERIMENTAL

Plant material.

Flowers of *Calycanthus fertilis* were collected during the flowering stage in June 2012 from public garden of Sabzevar in Khorasan Province, Iran. Voucher specimens were deposited at the herbarium of the Research Institute of Forests and Rangeland (TARI), Tehran, Iran.

Volatile isolation.

Air-dried flowers (100 g) were subjected to hydrodistillation for 3 h in a Clevenger-type apparatus to produce oil. After decanting and drying over anhydrous sodium sulfate, the colorless oil was recovered in a yield of 0.19% (w/w).

GC analysis.

Analytical gas chromatography was carried out on a Shimadzu 15 A gas chromatograph equipped with split/splitless injector (250 °C) and a flame ionization detector (250 °C). The carrier gas was nitrogen, at a flow rate of 1 ml/min. The capillary column used was DB-5 (50

m × 0.2 mm, film thickness 0.32 μm). The column temperature was kept at 60 °C for 3 min and then heated to 220 °C at a rate of 5 °C/min, after which time it was kept at 220 °C for 5 min. The characteristics have been depicted in Table 2.

GC/MS analysis.

A Hewlett-Packard 5973 apparatus fitted with a HP-5 MS column (30m × 0.25mm, film thickness 0.25 μm) was used. The column temperature was kept at 60 °C for 3 min and programmed to 220 °C at a rate of 5 °C/min and kept constant at 220 °C for 5 min. Helium was the carrier gas (1 ml/min). MS were taken at 70 eV.

Qualitative and quantitative analyses.

Identification of the constituents in the oil was made by comparison of their mass spectral fragmentation patterns and retention indices (KI) relative to C9-C21 n-alkanes with those given in the literature [8] and stored in the mass spectral database (Wiley 275). Relative percentages of the components were calculated from peak areas using a Shimadzu C-R4A Chromatopac, without the use of a correction factor.

RESULTS AND DISCUSSION

In this work the hydrodistilled volatile oil from the crushed, dry flowers of *Calycanthus floridus* L. var. *oblongifolius* (syn. *Calycanthus fertilis*) (Calycanthaceae) collected in Sabzevar, Khorasan Province, Iran, were studied by GC and GC/MS. The air dried flowers of this shrub yielded 0.19% (w/w) of colorless oil, whose percentage compositions are given in Table 2.

Eighteen compounds, accounting for 90.1% of the stem oil, were identified: five monoterpene hydrocarbons (22.7%), eight oxygenated monoterpenes (57.2%), two sesquiterpene hydrocarbons (0.8%) and three oxygenated sesquiterpenes (9.4%). The main components were 1,8-cineol (33.1%), bornyl acetate (14.1%), α-pinene (10.2%), elemol (8.2%), β-pinene (8.6%) and α-terpinyl acetate (5.8%). As can

be seen from the above information, in the stem oil of *Calycanthus fertilis* monoterpenes predominated over sesquiterpenes, and among the former, oxygenated monoterpenes were the major constituents, accounting for 57.2% of the total. No nonterpene hydrocarbons were found among the identified compounds. To the best of my knowledge this is the first report of essential oil composition from the flower of genus *calycanthus*.

Table 2: Percentage composition of stem oil components in *Calycanthus floridus* L. var. *oblongifolius*

No. ^a	compound	KI	percent(%)
1	α-pinene	939	10.2
2	camphene	953	3.1
3	β-pinene	980	8.6
4	1,8-cineol	1033	33.1
5	γ-terpinene	1062	0.3
6	terpinolene	1088	0.5
7	linalool	1098	1.2
8	terpinen-4-ol	1177	0.4
9	α-terpineol	1189	1.9
10	geraniol	1255	0.6
11	bornyl acetate	1289	14.1
12	α-terpinyl acetate	1350	5.8
13	neryl acetate	1365	0.1
14	germacrene D	1480	0.1
15	bicyclogermacrene	1494	0.7
16	elemol	1549	8.2
17	10-epi-γ-eudesmol	1619	0.9
18	γ-eudesmol	1630	0.3
Total percentage			90.1

a The compounds have been arranged according to their Kovatz retention indices (KI) on an HP-5MS capillary column.

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