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Short Communication

Characterization of essential oil content isolated from *Rhus flexicauli* (Baker)

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Abstract

In this study plant material was collected from *Rhus flexicauli* (Baker) *(R. flexicaulis)* shrubs grown wild on Gabal Elba region (approximately 1200 km south of Cairo, Egypt). Results of Phytochemical screening of *R. flexicaulis* plant showed that *R. flexicaulis* contains moderate amounts of carbohydrates and / or glycosides, sterols, flavonoids and tannins, while alkaloids, saponins, coumarines and anthraquinones were absent. The essential oil obtained by water distillation from aerial parts of *R. flexicaulis* yielded 0.1 - 0.3%.v/w on a dry weight. The composition of the essential oil was isolated from *R. flexicaulis* leaves and was analyzed by gas chromatography-mass spectrometry (GC-MS) technique. Twenty one constituents representing 66.4% of the Egyptian *R. flexicaulis* essential oils were identified. The major constituents of Egyptian *R. flexicaulis* essential oil are beta-bisabolene (30.3%), E-beta-farnesene (9.3%), beta-curcumene (6.6%) and caryophyllene oxide (4.3%). Four classes of compounds have been detected from *R. flexicaulis* oil like monoterpene hydrocarbons (MH), oxygenated monoterpenes (OM), sesquiterpene hydrocarbons (SH) and oxygenated sesquiterpenes (OS). The essential oil obtained from leaves of genus *R. flexicaulis* have been found to be rich in SH which amounted to 48.0%, followed by OS (13.7%), MH (3.2%) and OM (1.5%).

Introduction

Essential oils are volatile, natural, complex compounds characterized by a strong odor and are formed by aromatic plants as secondary metabolites. They are usually obtained by steam or hydro-distillation first developed in the middle ages by Arabs. Known for their antiseptic, i.e. bactericidal, virucidal, fungicidal, medicinal properties and their fragrance. They are used in embalmment, preservation of foods and as antimicrobial, analgesic, sedative, anti-inflammatory, spasmolytic and locally anesthesic remedies. Up to the present day, these characteristics have not changed much except that more is now known about some of their mechanisms of action, particularly at the antimicrobial level (Bakkali, 2008).

Rhus flexicaulis (Baker) *(R. flexicaulis)* belongs to family Ancardacea. It is a perennial shrub that reaches up to 2-3m long, leaves are compound with three sub orbicular to ovate-elliptic, sessile leaflets with entire margins rounded apex; the terminal leaflet is larger than the 2 lateral leaflets. Flowers are arranged in lax terminal panicles. The fruit is a brownish, glossy drupe. The plant is growing wild in the Egyptian desert east of the river Nile. (Boulos, 2000; Chang and But, 1986; El-Hadidi and Fayed, 1955). Chemical composition of *R. flexicaulis* essential oil has no studies, so, this present investigation was carried out to study the essential oil composition of *R. flexicaulis* plants as a new natural source of essential oil.

Materials and Methods

Plant material

Plant material was collected in March 2013 from wild plant populations of *R. flexicaulis* growing in sandy soils on western desert region (Gabal Elba) approximately 1200 km south of Cairo, Egypt. Identification of the species was achieved by Boulos (1995; 2000), National Research Centre Cairo Egypt Voucher specimens are in the herbarium of NRC, Cairo, Egypt.

Preliminary phytochemical screening

The powdered air-dried aerial parts of *R. flexicaulis* were screened for carbohydrates and / or glycosides; flavonoids, tannins, saponins, coumarins, sterols and / or triterpenes and alkaloids, applying chemical tests according to Harborne (1998).

Essential oil isolation

Dried leaves [divided into small pieces (0.5 - 1 cm)] were collected then 500 g from each replicate

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(three replicates) from many places of western desert region (Gabal Elba) were subjected to hydro-distillation for 3 h using a Clevenger-type apparatus (Clevenger, 1928). The essential oil content was calculated as a relative percentage (v/w). The samples of essential oils were dried over anhydrous sodium sulphate to identify the chemical constituents of the essential oil.

Gas chromatography (GC)

GC analyses were performed using a Shimadzu GC- 9A gas chromatograph equipped with a DB5 fused silica column (30 m x 0.25 mm i.d., film thickness 0.25µm). Oven temperature was held at 40°C for 5 min and then programmed until 250°C at a rate of 4°C/min. Injector and detector (FID) temperature were 260°C; helium was used as carrier gas with a linear velocity of 32 cm/s.

Gas chromatography-Mass spectrometry (GC-MS)

GC-MS analyses were carried out on a Varian 3400 system equipped with a DB-5 fused silica column (30 m x 0.25 mm i.d.); Oven temperature was 40 to 240°C at a rate of 4°C/min, transfer line temperature 260°C, injector temperature 250°C, carrier gas helium with a linear velocity of 31.5 cm/s, split ratio 1/60, flow rate 1.1 ml/ min, Ionization energy 70 eV; scan time 1 s ; mass range 40-350 amu.

The components of the oils were identified by comparison of their mass-spectra with those of a computer library or with authentic compounds and confirmed by comparison of their retention indices with those of authentic compounds. Kovat's indices (KI) or Retention indices (RI) (Kováts, 1958) were determined by co-injection of the sample with a solution containing a homologous series of n-hydrocarbons, in a temperature run identical to that described above.

Qualitative and quantitative analyses of essential oil

Identifications were made by library searches (Adams, 1995) combining MS and retention data of authentic compounds by comparison of their GC retention indices (RI) with those of the literature or with those of standards available in our laboratories. The retention indices were determined in relation to a homologous series of n-alkanes (C8–C22) under the same operating conditions. Further identification was made by comparison of their mass spectra on both columns with those stored in NIST 98 and Wiley 5 Libraries or with mass spectra from literature. Component relative concentrations were calculated based on GC peak areas without using correction factors.

Table.1. Essential oil constituents of *R. flexicaulis* identified by RI and MS

No.	Constituents	RI*	Class	Values (%)
1	*Alfa*-Pinene	939	MH	0.1
2	Sabinene	976	MH	0.1
3	*Para*-Cymene	1026	MH	0.3
4	Limonene	1031	MH	2.7
5	Linalool	1098	OM	1.1
6	Trans-Pinene hydrate	1137	OM	0.2
7	*Alfa*-Terpineol	1189	OM	0.1
8	Carvacrol	1298	OM	0.1
9	*Alfa*-cis-Bergamotene	1415	SH	0.5
10	*Beta*-Caryophyllene	1418	SH	0.5
11	*Alfa*-trans-Bergamotene	1434	SH	0.4
12	E-*Beta* –Farnesene	1458	SH	9.7
13	*Beta*-Bisabolene	1509	SH	30.3
14	*Beta*-Curcumene	1517	SH	6.6
15	cis-Nerolidol	1534	OS	0.6
16	Elemol	1547	OS	0.7
17	Caryophyllene oxide	1581	OS	4.3
18	*Gamma*-Eudesmol	1630	OS	0.3
19	Gossonorol	1632	OS	2.2
20	*Alfa*-Bisabolol	1683	OS	4.1
21	E-Z-Farnesol	1742	OS	1.5
Monoterpene hydrocarbons (MH)				3.2
Oxygenated monoterpene (OM)				1.5
Sesquiterpene hydrocarbons (SH)				48.0
Oxygenated sesquiterpene (OS)				13.7
Total identified				66.4
RI*: Confirmed by comparison with Retention indices on DB5 column (Adams, 1995).				

Results and Discussion

Results of phytochemical screening showed that *R. flexicaulis* contains moderate amounts of carbohydrates and / or glycosides, sterols, terpenes, flavonoids and tannins, while alkaloids, saponins, coumarines and anthraquinones were absent. The essential oil obtained by water distillation from aerial parts of *R. flexicaulis* yielded 0.1 - 0.3%.v/w on a dry weight. Twenty one constituents representing 66.4% of the Egyptian *R. flexicaulis* essential oil was identified (Table 1). The major components of Egyptian *R. flexicaulis* essential are beta-bisabolene (30.3%), E-beta-farnesene (9.3%), beta-curcumene (6.6%) and caryophyllene oxide (4.3%). In the same table (Table 1) data indicated that four classes of compounds have been detected from *R. flexicaulis* oil like monoterpene hydrocarbons (MH), oxygenated monoterpenes (OM), sesquiterpene hydrocarbons (SH) and oxygenated sesquiterpenes (OS). The essential oils obtained from leaves of genus *R. flexicaulis* have been found to be rich in SH which amounted to (48.0%), followed by OS (13.7%), MH (3.2%) and OM (1.5%). SH include the constituents of

alfa-cis-bergamotene, beta-caryophyllene, alfa-trans-bergamotene, E-beta-farnesene, beta-bisabolene and beta-curcumene. Beta-bisabolene represented the highest concentration. This indicates that *R. flexicaulis* essential oil grown in Egypt belongs to the beta-bisabolene chemo-type. These compounds represent 48.0% (area percent) of the total oil. Beta-bisabolene is reportedly a potent non-phytotoxic antifeedant against *Leptinotarsa decemlineata* (Say) (Gonzalez-Coloma *et al*., 1995) and *Myzus persicae* Sulzer (Gutierrez *et al*., 1997). Meanwhile, beta-bisabolene was the one of major constituent in several plants such as *Psammogeton canescens,* 33.5% (Bamonri *et al.,* 2009); *Alpinia galanga*, 11.8% (Damayantti *et al.*, 2015); *Prangos ferulacea*, 12.1% (Massumia *et al*., 2007). It may be concluded that this is the first study to examine the composition of essential oil of *R. flexicaulis* plant under conditions of Egypt, and highlight it, which leads us to conduct further studies and analysis of other chemical groups under the Egyptian desert environment conditions

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