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STUDIES ON THE ESSENTIAL OILS OF THE PAKISTANI SPECIES OF THE FAMILY UMBELLIFERAE

Part XLI *Seseli libanotis*, (L), W. KOCH (Chota Eachga) Seed Oil

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The percentage yield, physicochemical values and the chemical composition of the essential oil steam-distilled from the fresh mature seed of *Seseli libanotis* have been determined. The oil is constituted of santene (0.08%), α-thujene (2.33%), α-pinene (2.73%), α-fenchene (0.38%), camphene (0.28%), sabinene (6.18%), β-pinene (0.78%), myrcene (2.45%), α-phellandrene (4.87%), Δ^3-carene (0.40%), γ-terpinene (6.50%), β-ocimene-x (9.20%), β-ocimene-y (0.88%), 2,6-dimethyl-oct-l-*trans*, 3.7-triene (0.09%), terpinolene (0.10%), linalool (0.10%), borneol (0.03%), terpinon-4-ol (0.08%),geraniol (0.15%), trimethyl benzyl alcohol (0.05%), longipinene (0.08%), humulene (0.38%), β-bourleonene (1.52%), β-elemene (1.15%), *trans*-β-farnesene (0.68%), β-caryophyllene (0.78%), β-selinene (1.93%), alloaromadendrene (14.60%), humulene (3.68%), α-muurolene (0.58%), α-farnesene (0.95%), longifolene (1.53%), α-cadinene (2.80%), isolongifolene (0.90%), 1, 3-5-triisopropyl benzene (0.68%), α-selinene (0.76%), β-bisabolene (6.81%), γ-muurolene (1.19%), a hydroxy ester (4.80%) and a mixture of coumarins (6.85%). The oil is chiefly composed of terpenes, i.e. 88% of the total oil.

INTRODUCTION

Seseli, a genus of 80 species, is distributed mainly in the temperate regions of Europe, Asia and Australia. The plants are annual or perennial herbs. Only two species, namely, *Seseli diffusum* and *Seseli libanotis* have been located in Pakistan. *Seseli libanotis* grows wild in Gilgit, Chitral, Dir, Ziarat, Kaghan and Swat. The seeds of the plant have been reportedly used in fall of blood pressure, vasoconstriction and respiratory stimulation. The species is one of the most important members of the family Umbelliferae.

The present studies have been carried out to evaluate the quality and chemical composition of the essential oil of the indigenous species to obtain basic information for use in developing new agricultural sources of such oils.

MATERIALS AND METHODS

Fresh and mature seed of *Seseli libanotis* were hand collected from Kalam (Swat) for these studies. The oil from the crushed material was steam-distilled according to the standard procedure [1]. The general methods used for these studies have been reported in our earlier publications [1, 2]. Besides these methods, time and temperature-programmed gas-liquid chromatography coupled with mass spectrometry was used for the resolution of the oil and identification of the various componets.

The oil was split into hydrocarbons and oxygenated components by silica gel column chromatography. The hydrocarbon fraction was eluted from the column with n-hexane and further resolved into individual components by GLC. The oxygenated components were eluted from the column with 1, 5, 10 and 50% of diethyl ether in n-hexane and their identification was carried out by GLC and IR comparison against their standard samples. However, in view of the complex nature of the oil, which was chiefly composed of monoterpenes and sesquiterpenes, it was resolved by time and temperature GLC using a Varian gas chromatograph(2100) with ionization detector and the various components were identified from their mass spectra.

RESULTS

The percentage yield, physicochemical values and the chmeical composition of the essential oil of *Seseli libanotis* are recorded in Tables 1–2. Fig. 1 shows the chromatogram of the essential oil.

DISCUSSION

The essential oil of the *Seseli libanotis* seed is quite

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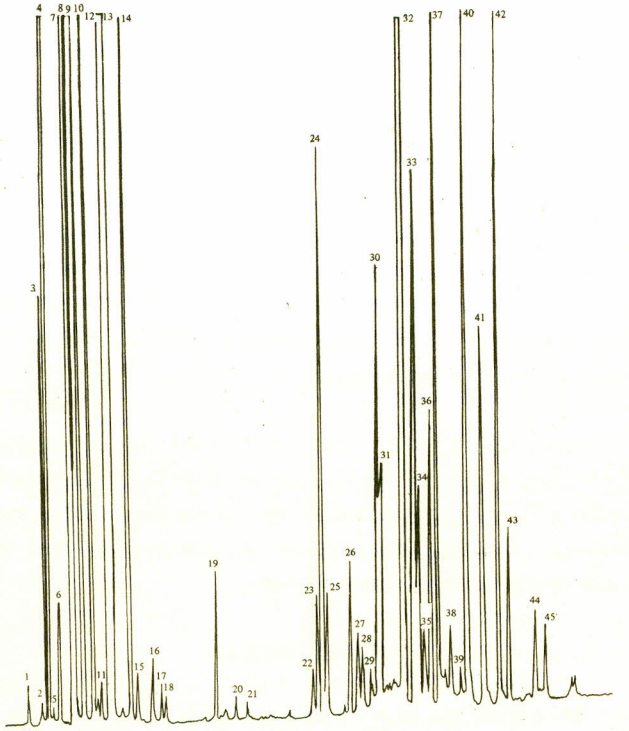

Fig. 1. Time and temperature programmed GLC of the essential oil of *Seseli libanotis.*

Table 1. Percentage yield and physicochemical values of the essential oil of ***Seseli libanotis*** seed.

Distilation time (hr)	8
Yield of the oil (%)	1.52
Specific gravity	0.8480^{29}
Refractive index	1.4990^{29}
Optical rotation	-6^{o} 50'29
Acid values	0
Ester values	2.12

Superscripts indicate the temperature at which these parameters were determined.

pleasant to smell, and is chiefly composed of terpenes. It was column-chromatographed on silica gel into hydrocarbons (88% of the total oil) and oxygenated components (12%). The hydrocarbon fraction of the oil consisted of a large number of monoterpenes and sesquiterpenes while the oxygenated fraction contained a mixture of alcohols (0.45%), a hydroxy ester (4.08%)and a mixture of coumarins (6.85%).

Handa *et al.* [3] showed the presence of α-pinene, camphene, β-pinene, myrcene, limonene, *p*-cymene, β-phellandrene, fenchone, fenchyl acetate and fenchyl alcohol as the constituents of the essential oil obtained from the roots of *Seseli sibricum (Seseli libanotis).* Kapoor and his coworkers [4] also analysed the essential oil of *Seseli sibricum* roots and reported fenchyl-*p*-hydroxy cinnamate and

Table 2. Percentage composition of the essential oil of *Seseli libanotis* seed.

Peak No	Component	Percentage
1.	Santene	0.08
2.	Unknown monoterpene	0.46
3.	α-Thujene	2.33
4.	α-Pinene	2.73
5.	α-Fenchene	0.38
6.	Camphene	0.28
7.	Sabinene	6.18
8.	β-Pinene	0.78
9.	Myrcene	2.45
10.	α-Phellandrene	4.87
11.	Δ^3-Carene	0.40
12.	γ-Terpinene	6.50
13.	β-Ocimene-x	9.20
14.	β-Ocimene-y	0.88
15.	2, 6-Dimethyl-oct-l-*trans,* 3-7-triene	0.09
16.	Terpinolene	0.10
17.	Linalool	0.10
18.	Borneol	0.03
19.	Geraniol	0.15
20.	Terpinene-4-ol	
21.	Trimethyl benzyl alcohol	0.05
22.	Longipinene	0.08
23.	γ-Humulene	0.38
24.	β-Bourleonene	1.52
25.	β-Elemene	1.15
26.	*Trans*-β-Farnesene	0.68
27.	-do-	0.53
28.	Unknown sesquiterpene	0.71
29.	β-Caryophyllene	0.78
30.	β-Selinene	1.93
31.	Unknown sesquiterpene	0.40
32.	Alloaromadendrene	14.60
33.	Humulene	3.68
34.	α-Muurolene	0.58
35.	α-Farnesene	0.95
36.	Longifolene	1.53
37.	α-Cadinene	2.80
38.	Isolongifolene	0.90
39.	1, 3, 5-Triisopropyl benzene	0.68
40.	α-Selinene	0.76
41.	Unknown sesquiterpene	3.95
42.	β-Bisabolene	6.81
43.	Unknown sesquiterpene	2.55
44.	γ-Muurolene	1.19
45.	Unknown sesquiterpene	1.19
A hydroxy ester*		4.80
Mixture of coumarins*		6.85

*Estimated by column chromatogrphy.

osthole in the oil.

The essential oil obtained from the seed of the indigenous *Seseli libanotis,* was, however, resolved into 45 components by time and temperature-programmed GLC using a column (30 m × 0.25 mm) packed with SE-30 and flame ionization detector. The temperature was programmed between 70–180° at the rate of 2°/min. The components, thus resolved, included 16 monoterpenes, 5 alcohols and 20 sesquiterpenes (Table 2). These compounds were identified from their mass spectra. The hydroxy ester and coumarins, which were isolated from the oil by column chromatography, did not seem to appear in the chromatograms.

As regards fenchyl acetate, fenchone and fenchyl alcohol, which have been reported by earlier workers [3] in the roots of *Seseli sibricum (Seseli libanotis),* the presence of these compounds could not be established in the essential oil of the seeds of the indigenous *Seseli libanotis.* On the other hand, five alcohols namely linalool, geraniol, borneol, terpinen-4-ol and trimethyl benzyl alcohol were identified in the Pakistani oil of the species.

The oil when column chromatographed on silica gel gave a mixture of coumarins. The major coumarin in the fraction was identified to be osthole. It was separated from the mixture by preparative TLC under UV light and identified by IR and UV absorption as compared with an authentic sample of this compound extracted from *Angelica glauca* [5]. A hydroxy ester, by IR, was also recovered from the column with 10% diethyl ether in n-hexane. Such a type of compound like fenchyl-*p*-hydroxy cinnamate has already been identified in the essential oil of *Seseli sibricum* of the Indian variety. Nevertheless, complete identification of the compound in our oil as yet to be carried out.

The present studies indicate that the essential oil obtained from the seed of the Pakistani *Seseli libanotis* constitutes entirely different components from that of the essential oil from the roots of the Indian variety of this species except that both oils have identical monoterpenes. We are, nevertheless, presenting a detailed chemical analysis of the essential oil of the indigenous *Seseli libanotis* using the most modern instruments.

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