

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

Part. XXVII. *Sium latijugum* C.B. Clarke (Theem) Seed Oil

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The physicochemical characteristics and chemical composition of the essential oil, steam distilled from the mature seeds, of *Sium latijugum* have been studied for the first time so far as Pakistani species is concerned. The composition of the oil (yield 2.87%) by GLC is α -thujene (0.16%), α -pinene (0.73%), camphene (5.48%), β -pinene (0.07%), sabinene (22.14%), myrcene (11.07%), unknown monoterpene (0.71%), α -phellandrene (0.21%), γ -terpinene (0.50%), limonene (31.82%), *m*-menthyl(6)8-diene (0.24%), Δ^3 -carene (6.5%), 1,8-cineole (0.10%), Δ^4 -carene (0.20%), 4-cyclohexyl-butan-2-one (0.18%), ethyl benzoate (0.35%), unknown (0.35%), an oxy compound (0.12%), benzyl alcohol (0.85%), epoxy-campholenic aldehyde (0.46%), dipenten oxide (0.07%), 1-undecene (0.07%), pinocamphone (0.62%), terpinen-4-ol (0.57%), 2,2-diallyl-cyclohexan-*cis*-1,3-diol (0.03%), myrtenal (1.78%), 1-*p*-menthen-9-al (0.27%), methyl thymol ether (0.14%), carvone (1.34%), perillaldehyde (0.71%), cuminaldehyde (4.40%), thymol (1.34%), unknown oxygenated compounds (0.08%), β -caryophyllene (0.30%), β -bergamoten (0.10%), *trans*- β -farnesene (1.28%), unidentified sesquiterpene (0.07%), alloaromadendrene (0.89%), 9-cycloheptadecanone (0.27%) farnesol (0.96%), cedrol (0.05%) and unidentified sesquiterpenic alcohols and coumarins (2.49%).

Forty-nine components have been detected in the essential oil of *Sium latijugum*. The oil is mainly composed of hydrocarbons.

INTRODUCTION

Sium is a cosmopolitan genus of about 15 species. It is distributed throughout the world except South America and Australia. It includes aquatic or marshy plants. Only one species namely *Sium latijugum* has been recorded to grow in Pakistan.

Sium latijugum, an annual plant, grows wild in Gilgit, Hazara, Swat (Kalam) in the North West Frontier Province and Chuwa Saidu Shah in the Punjab. The plant possesses pleasant smell. The species has been reported to be used in the fall of blood pressure and depression in the central nervous system. The essential oil of the species indicates hypotensive central nervous system. The essential oil of the species indicates hypotensive central nervous depressant and smooth muscle relaxant effect [1].

The present studies have been carried out with a view to determining the quality and chemical composition of *Sium latijugum* grown in Pakistan. These are the first ever studies of this kind as regards the Pakistani species.

EXPERIMENTAL

Materials and Methods

Fresh mature seeds of *Sium latijugum* were collected from Kalam (Swat). The essential oil from the crushed seeds was recovered by the normal procedure of dry steam distillation [2]. The general methods employed for these investigations are described in our earlier publications [2,3]. Besides these methods, a time and temperature programmed GLC coupled with mass spectrometry was used to analyse the oil. For this analysis a Varian gas chromatograph (2100) with flame ionisation detector was employed.

RESULTS

The physicochemical properties and the chemical composition of the essential oil are recorded in Tables 1 and 2. Fig. 1 shows the chromatogram of the oil.

DISCUSSION

The essential oil recovered from the seeds of *Sium*

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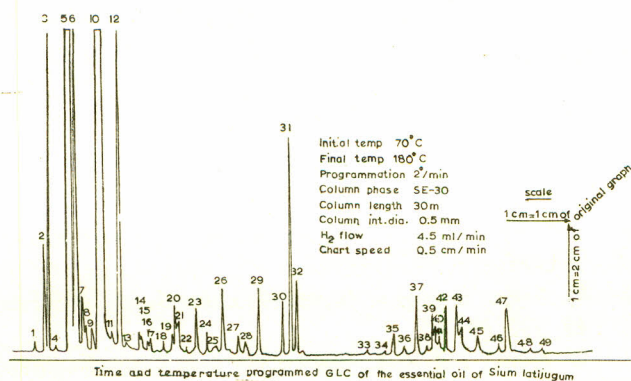


Fig. 1

 Table 1. Physicochemical properties of the essential oil of *Sium latijugum* seeds.

Time of distillation (hr)	8
Yield of oil (%)	2.87
Specific gravity	0.9750 ²⁸
Refractive index	1.4890 ²⁸
Optical rotation	+50 ⁰
Acid value	0.27
Ester value	1.60

The superscripts indicate the temperature at which these parameters were determined.

latijugum is mainly composed of hydrocarbons (~80%). The hydrocarbon fraction of the oil consisted of a large number of monoterpenes and sesquiterpenes. The terpenes were identified by GLC comparison against the available standard samples and also by GLC/MS.

Sarin [4] analysed *Sium latijugum* of the Indian origin and found that the fruit oil mainly consisted of limonene (78%), carvotanacetone (3.0%) and pinocarveol (1.6%). The oil distilled from the whole plant on the other hand showed the presence of camphene (20%), Δ -limonene (24%), terpinolene (23%), carvotanacetone (3%) and an unknown alcohol (15%). Talwar and Handa [5] have reported the presence of camphene, δ -limonene, terpinolene, an ester, carvotanacetone and an alcohol in the essential oil recovered from the leaves of *Sium latijugum*.

In the present work 49 components have been detected by GLC, in the essential oil distilled from the seeds of Pakistani *Sium latijugum*. The chemical composition of the Pakistani species differs from the Indian variety especially in the oxygenated fraction.

The essential oil was tried to resolve into components by column chromatography but due to the complex nature of the oil we were unable to obtain the individual

 Table 2. Percentage composition of the essential oil of *Sium latijugum* seeds by programmed GLC.

Peak No.	Component	Percentage
1.	α -Thujene	0.16
2.	α -Pinene	0.73
3	Camphene	5.48
4	β -Pinene	0.07
5	Sabinene	22.14
6	Myrcene	11.07
7	Fenchene	0.71
8	α -Phellandrene	0.21
9	γ -Terpinene	0.50
10	Limonene	31.82
11	<i>m</i> -Mentha-1(6)-8-diene	0.24
12	Δ^3 -Carene	6.57
13	1,8- cineole	0.10
14	Δ^4 -Carene	0.20
15	4-Cyclohexyl-butan-2-one	0.18
16	Ethyl benzoate	0.30
17	Unknown	0.35
18	An oxy-compound	0.12
19	Benzyl alcohol	0.85
20	Epoxy campholenic aldehyde	0.46
21	Dipenten oxide	0.07
22	1-Undecene	0.07
23	Pinocamphone	0.62
24	Terpinen-4-ol	0.57
25	2,2-Diallylcyclohexan- <i>cis</i> -1,3-diol	0.03
26	Myrtenal	1.78
27	1-p-Menthen-9-al	0.27
28	Methyl thymol ether	0.14
29	Carvone	1.34
30.	Perillaldehyde	0.71
31	Cuminaldehyde	4.40
23	Thymol	1.34
33	Unknown	0.05
34	-do-	0.03
35	β -Caryophyllene	0.30
63	β -Bergamotene	0.10
64	<i>Trans</i> - β -Farnesene	1.28
38	Unknown sesquiterpene	0.07
39	Allo-aromadendrene	0.89
40 to 42	Unknown	1.07
43	Farnesol	0.96
44	Unknown	0.09
45	9-Cycloheptadecanone	0.27
46	Unknown	1.14
47		
48	Cedrol	0.05
49	Unknown	0.05

components in pure form. The oil was, therefore, examined by GLC coupled with mass spectrometry. Identification

of the various compounds was made from their mass spectra compared with the standard ones. A few of the components in the present studies, remained unidentified. These compounds are expected to be coumarins and sesquiterpenic alcohols. The present work, however, shows a detailed chemical composition of the essential oil of the indigenous species.

Sium latijugum has been reported to possess valuable medicinal importance. Therefore, a detailed study on these lines may prove quite useful. Our cultivation of the species in these Laboratories will then be a success.

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