

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

Part XLVI. *Stewartiella baluchistanica*, E. Nasir, Oil of the Whole Plant

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The essential oil steam-distilled from the whole plant of *Stewartiella baluchistanica* has been characterised and studied with respect to its physicochemical properties and chemical composition. The oil obtained in 0.15% yield consisted of: methyl benzene (1.87%), ethyl benzene (0.09%), xylene (0.13%), pentyl benzene (0.09%), 2, 3-dimethyl-3-ethyl pentane (0.52%), linalyl acetate (traces), methyl ethyl benzene (traces), 4-Ti-butyl cyclohexane (traces), *trans*-sabinone hydrate (0.07%), 2-methyl-4-hexyl hexanone (0.04%), isobutyl benzene (0.09%), phenyl methyl ketone (0.29%), *m*-menth-1, 8(9)-diene-5-ol (0.08%), cumene (0.94%), *n*-decane (1.30%), methyl benzaldehyde (0.15%), 1-methyl-4-isopropyl-1,3-cyclohexadiene (0.15%), 4-ethyl-1-octyn-3-ol (0.09%), pinene-oxide (0.10%), limonene-4-ol (0.17%), isocarvomenthone (1.17%), *trans*-pinocarvone (0.34%), eucarvone (1.51%), verbinone (0.55%), pulegone (5.38%), dec-3-en-2-one (0.52%), dec-4-en-2-one (0.44%), thymol (0.65%), *cis-p*-menthadiene-2, 8-ol-1 (3.71%), carveol (12.34%), chavicol (0.84%), β -terpinene-3,4-oxide (0.14%), 2-methyl terephthaldehyde (2.30%), sabinol (15.83%), trimethyl benzaldehyde (0.14%), γ -muurolene (7.23%), isolongifolene (0.10%), 1-phenyl-4-methyl-octane (0.19%), γ -cadinene (0.79%), α -cadinene (0.14%), β -bisabolene (0.55%), β -elemene (1.16%), β -selinene (1.08%), β -caryophyllene (0.03%), humulene (0.28%), pinocarveol (2.76%), methyl chavicol (3.49%) and some unidentified sesquiterpenes and phenolic components. The essential oil of the *Stewartiella baluchistanica* is unique among umbellifer because none of the members of the family has so far been reported to contain such a large number of components. One hundred and nine compounds have been detected in the oil and we have succeeded in identifying about fifty of these compounds. It will be quite interesting to study the physiological effect of the oil so as to introduce the species in the local materia medica.

INTRODUCTION

The genus *Stewartiella* is named in honour of Dr. R.R. Stewart, a renowned U.S. botanist who has studied the flora of the Indo-Pakistan subcontinent. It includes only one species which is known as *Stewartiella baluchistanica*. The plant is a perennial herb and is native to Pakistan where it grows wild at Maslakh and Kachh in the Baluchistan province. No medicinal value of the species is known so far. The plant is mainly grazed by animals.

The present studies have been carried out with a view to determining the quality and chemical composition of the essential oil of the species so that the natural resources of the country may be exploited. These are the first ever studies of this kind which provide a detailed analysis of the essential oil of *Stewartiella baluchistanica*.

MATERIALS AND METHODS

Green plants of *Stewartiella baluchistanica* were collected from Kachh (Baluchistan). The essential oil from the crushed material was recovered by dry steam-distillation

according to the method described earlier [1]. The general methods used for the analysis of the oil have been reported earlier [1, 2]. Besides these methods, time and temperature-controlled gas-liquid chromatography coupled with mass spectrometry was used for the resolution of the oil and identification of the various components.

RESULTS

The percentage yield, physicochemical properties and the chemical composition of the essential oil of *Stewartiella baluchistanica* green plants have been recorded in Tables 1-2. Fig. 1 shows the resolution of the essential oil of the species.

DISCUSSION

The essential oil recovered from the whole plant of *Stewartiella baluchistanica* is quite pleasant to smell. No work has so far been appeared in literature upon the nature and chemistry of the essential oil of this species. The present studies, therefore, provide entirely new information about the physicochemical investigations on the essential oil obtained from the indigenous species of *Stewartiella*. A

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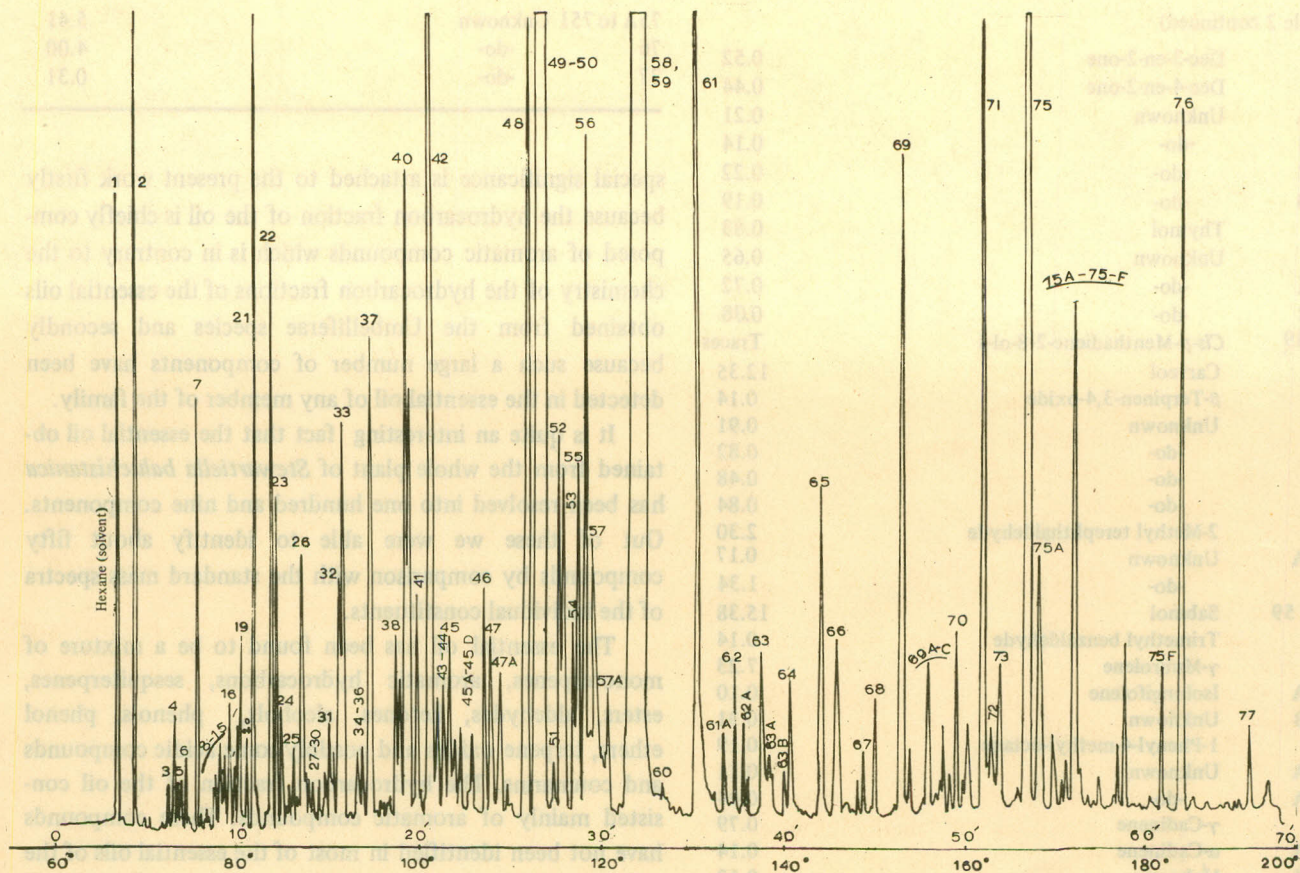

 Fig. 1. Time and temperature-programmed GLC of the essential oil of *Stewartiella baluchistanica*, SE-30, 0.25 mm, 68°/20°/min, 200°

 Table 1. Percentage yield and physicochemical values of the essential oil of *Stewartiella baluchistanica* green plants.

Distillation time (hr).	10
Yield of the oil (%)	0.15
Specific gravity	0.89 ¹⁰ 22
Refractive index	1.51 ³⁰ 22
Optical rotation	+10° 30° 22
Acid value	19.21
Ester value	8.25

Superscripts indicate the temperature at which these parameters were determined.

 Table 2. Chemical composition of the essential oil of *Stewartiella baluchistanica* green plant by programmed GLC.

Peak No.	Component	Percentage
1	Hexane (solvent)	1.45
2	Methyl benzene	1.87
3	Ethyl benzene	0.90
4	Xylene	0.13
5	Unknown	0.07
5A	-do-	0.06
6	Pentyl benzene	0.09
7	2, 3-Dimethyl-3-ethyl pentene	0.52
8	Linalyl acetate	Trace
9	Methyl ethyl benzene	Traces
10	4-Tr-Butyl cyclohexane	Traces
11	Unknown	0.10
12	<i>Trans</i> -Sabinene hydrate	0.07
13	Unknown	0.10
14	2-Methyl-4-hexyl hexanone	0.04
15	Isobutyl benzene	0.09
16	Phenyl methyl ketone	0.29
17	Unknown	0.07
18	<i>m</i> -Mentha-1, 8(9)-diene-5-ol	0.08
19	Unknown	0.45
20	-do-	0.10
21	Cumene	0.94
22	<i>n</i> -Decane	1.36
23	Unknown	0.58
24	Methyl benzaldehyde	0.15
25A	No mass spectra recorded	0.10
25	Unknown	0.09
26	-do-	0.49
27	Unknown	0.12
28	1-Methyl-4-isopropyl-1, 3-cyclohexadiene	0.10
29	4-Ethyl-1-octyn-3-ol	0.09
30	α -Pinene oxide	0.10
31	Unknown	0.24
31A	-do-	0.09
32	-do-	0.28
33	-do-	0.95
34, 35	Limonen-4-ol	0.17
36	Unknown	0.19
37	Isocarvomenthone	1.17
38	Unknown	0.45
39	<i>Trans</i> -Pinocarvone	0.34
40	Eucarvone	1.15
41	Verbinene	0.55
42	Pulegone	5.38
43	Unknown	0.06

(Table 2 continued)

44	Dec-3-en-2-one	0.52
45	Dec-4-en-2-one	0.44
45A	Unknown	0.21
45B	-do-	0.14
45C	-do-	0.22
45D	-do-	0.19
46	Thymol	0.83
47	Unknown	0.65
47A	-do-	0.72
47B	-do-	0.08
48,49	Cis-p-Menthadiene-2-8-ol-1	Traces
50	Carveol	12.35
51	β -Terpinen-3,4-oxide	0.14
52	Unknown	0.91
53	-do-	0.82
54	-do-	0.48
55	-do-	0.84
56	2-Methyl terephthaldehyde	2.30
57A	Unknown	0.17
57	-do-	1.34
58, 59	Sabinol	15.38
60	Trimethyl benzaldehyde	0.14
61	γ -Murolene	7.23
61A	Isolongifolene	0.10
61B	Unknown	0.31
62	1-Phenyl-4-methyl-octane	0.19
62A	Unknown	0.11
62A	-do-	0.04
63	γ -Cadinene	0.79
63A	α -Cadinene	0.14
63B	Unknown	0.12
64	β -Bisabolene	0.55
65	β -Elemene	1.16
66	β -Selinene	1.08
66A	Unknown	Traces
67	β -Caryophyllene	0.03
68	Humulene	0.28
69	Unknown	4.60
69A	-do-	0.15
69B	-do-	0.34
69C	-do-	0.09
69D	-do-	0.04
70	-do-	0.43
70A	-do-	0.10
70B	-do-	0.03
71	Pinocarveol	2.76
72	Unknown	0.20
73	-do-	0.38
74	-do-	0.03
75	Methyl chavicol	3.49

75A to 75I	Unknown	5.41
76	-do-	4.00
77	-do-	0.31

special significance is attached to the present work firstly because the hydrocarbon fraction of the oil is chiefly composed of aromatic compounds which is in contrary to the chemistry of the hydrocarbon fractions of the essential oils obtained from the Umbelliferae species and secondly because such a large number of components have been detected in the essential oil of any member of the family.

It is quite an interesting fact that the essential oil obtained from the whole plant of *Stewartiella bahuchistanica* has been resolved into one hundred and nine components. Out of these we were able to identify about fifty compounds by comparison with the standard mass spectra of the individual constituents.

The essential oil has been found to be a mixture of monoterpenes, aromatic hydrocarbons, sesquiterpenes, esters, aldehydes, ketones, alcohols, phenols, phenol ethers, terpene oxides and possibly some acidic compounds and coumarins. The hydrocarbon fraction of the oil consisted mainly of aromatic compounds. These compounds have not been identified in most of the essential oils of the umbelliferous plants. It is essential to carry out further studies upon the physiological nature of the essential oil.

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