

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

### Part XXXII. *Chaerophyllum reflexum*, Lindl (Kangoo) Essential Oil of the Whole Plant

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(Received May 19, 1979)

**Abstract.** The essential oil steam-distilled from the whole plant of *Chaerophyllum reflexum*, grown wild in Pakistan has been characterised and studies with respect to its physico-chemical properties and chemical composition. The oil with a yield of 0.25% is composed of santene (1.2%),  $\alpha$ -pinene (0.7%), camphene (3.9%),  $\beta$ -pinene (2.2%),  $\gamma$ -terpinene (3.1%),  $\alpha$ -phellandrene (0.7%), *p*-cyemene (8.6%), an unknown monoterpene (0.5%), myristicin (17.3%), carvone (0.8%), 1,8-cineole (2.5%),  $\alpha$ -terpineol (4.1%) and hydroxy myristic acid (27.4%). The essential oil of the species possesses reasonably good smell. It will be quite interesting to study the medicinal importance of the plant.

#### Introduction

The genus *Chaerophyllum* is represented by about 40 species distributed in the North temperate regions, chiefly in Europe and Asia. In Pakistan, only 5 species namely *Chaerophyllum acuminatum*, *C. aquilegifolium*, *C. capnoides*, *C. reflexum* and *C. villosum* are recorded to grow wild in the North West Frontier Province and Azad Kashmir. The plants are annual herbs.

*Chaerophyllum reflexum* grows wild at Kalam and Ushu in the Swat District, Kaghan in the Hazara District and also in Azad Kashmir. The plant is mainly grazed by animals.

The present investigations have been carried out with a view to determining the quality and chemical composition of the essential oil of *Chaerophyllum reflexum*. This is the first ever study of this kind as regards the indigenous species.

#### Experimental

**Materials and Methods.** For the present studies the plant was collected from Kaghan. Its oil was distilled by the standard procedure.<sup>1</sup> The general methods of analysis used for this work have been described in our earlier publications.<sup>1,2</sup> A Pye Unicam GLC machine was used for the resolution of the oil and identification of its components.

**Chromatographic Analysis of the Oil.** The oil was split into hydrocarbon-fraction and oxygenated components by column chromatography<sup>3,4</sup> using silica gel as

an adsorbent. The hydrogen fraction was further resolved into individual components by GLC using a stainless steel column (3 mm x 3 m) packed with SE-30, nitrogen as the carrier gas and flame ionisation detector. The column temperature was maintained at 110°. The oxygenated components of the oil, as separated by column chromatography, were identified by IR and GLC comparison and also by preparing their known derivatives.

#### Results

The percentage yield, physico-chemical values and the chemical composition of the essential oil of *Chaerophyllum reflexum* are recorded in Tables 1 and 2.

TABLE 1. PERCENTAGE YIELD AND PHYSICO-CHEMICAL VALUES OF THE ESSENTIAL OIL OF *Chaerophyllum reflexum* WHOLE PLANT.

Distillation period	8 hr
Yield of oil	0.25%
Specific gravity	0.9954 <sup>20</sup>
Refractive index	1.3770 <sup>20</sup>
Optical rotation	+1° 32' <sup>20</sup>
Acid value	8.82
Ester value	8.41

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



TABLE 2. PERCENTAGE COMPOSITION OF THE ESSENTIAL OIL OF *Chaerophyllum reflexum* WHOLE PLANT.

Eluent	Component	Percentage	
n-Hexane	Hydrocarbons*	47.4	
	Santene	1.2	
	Unknown monoterpene	0.5	
	$\alpha$ -Pinene	0.7	
	Camphene	3.9	
	$\beta$ -Pinene	2.2	
	Myrcene	17.1	
	$\Delta^3$ -Carene	8.2	
	$\alpha$ -Phellandrene	1.3	
	$\gamma$ -Terpinene	3.1	
	$\beta$ -Phellandrene	0.6	
	<i>p</i> -Cymene	8.6	
	2% Diethyl ether in n-hexane	Myristicin	17.3
	5% Diethyl ether in n-hexane	Carvone	0.8
20% Diethyl ether in n-hexane	1,8-Cineole	2.5	
20% Diethyl ether in n-hexane	$\alpha$ -Terpineol	4.1	
50% Diethyl ether in n-hexane	Hydroxy myristic acid	7.4	
	Unrecovered material	0.5	

\*Resolved and estimated by GLC.

### Discussion

The essential oil of *Chaerophyllum reflexum* is composed of about 47% hydrocarbons; myrcene being the major component of this fraction. The fraction, as eluted from the column with n-hexane, was resolved by GLC and the individual components were identified by comparison method.

Elution of the column with 2% diethyl ether in n-hexane gave a single compound which was identified as myristicin by TLC and IR comparison with the standard sample of this phenol ether. On treatment with bromine in dry ether, it gave tetra-bromide, m.p. 127-128° (lit.<sup>5</sup>, 130°). The column was then eluted with 5% diethyl ether in n-hexane which gave a ketonic compound by IR and chemical tests. The compound was identified as carvone by TLC and IR comparison with its authentic sample.

Further elution of the column was carried out with 20% diethyl ether in n-hexane which gave a mixture of 2-3 compounds by TLC. The fraction was alcoholic in nature by IR. Column chromatography followed by preparative TLC of this fraction gave two pure compounds. The major portion of the fraction consisted of  $\alpha$ -terpineol by TLC, IR and GLC comparison. The second compound was identified to be 1, 8-cineole by TLC and IR comparison with its authentic sample.

Finally, the column was eluted with 50% diethyl ether in n-hexane which gave a single compound. On removal of the solvent, the fraction changed into crystalline form. The compound was identified to be hydroxy myristic acid (m.p. 54°) and by IR comparison.

The essential oil of *Chaerophyllum reflexum* possesses pleasant flavour and can find application in perfumery, but low yield of the essential oil may not allow the species to be commercialised. However, it will be interesting to study the medicinal importance of the plant so as to utilise the natural resources of the country for the welfare of human beings.

**Acknowledgement.** We are grateful to the United States Department of Agriculture for financing this research under a PL-480 Project and Mr. Abdul Waheed Sabir, our Botanist, for the identification and procurement of authentic samples.

We are also thankful to Dr. F.M. Chaudhary of these Laboratories for doing GLC for this work.

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