

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

### Part XXXIII. *Peteroselinum crispum*, Miller (Parsley) Seed Oil

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**Abstract.** A study on the physico-chemical characteristics and chemical composition of the essential oil obtained from the seeds of *Peteroselinum crispum*, has been made. The oil with an yield 1.93% contains  $\alpha$ -thujene (0.26%),  $\alpha$ -pinene (24.85%), camphene (0.19%), sabinene (1.04%),  $\beta$ -pinene (20.39%), myrcene (0.52%), *p*-cymene (0.46%), (+) *m*-mentha-1(6)-8-diene (5.64%), myrtenal (0.06%), 1-*p*-menthen-9-al (0.38%), citronellal (0.18%), santenone (0.05%), pinocamphone (0.21%), campherone (0.27%), piperitone (0.25%),  $\alpha$ -terpineol (0.15%), isomyrcenol (0.12%),  $\beta$ -bisabolene (0.53%),  $\beta$ -caryophyllene (0.29%),  $\beta$ -farnesene (1.42%), myristicin (30.12%), elemicin (4.27%), 1-allyl-2,3,4,5-tetramethoxybenzene (0.79%) and apiole (0.39%). The oil is used in high-grade perfumery. Cultivation of such a useful species can provide a valuable commodity for the distillation of its essential oil.

#### Introduction

*Peteroselinum* is a genus of 3 species with a wild distribution in Asia, Europe and North and South America. The plants are biennial, rarely annual herbs. In Pakistan, only one species namely *Peteroselinum crispum* has been reported to grow.

*Peteroselinum crispum*, a cosmopolitan cultivated plant, commonly known as Parsley, is used for edible foliage. It is an important species of the family Umbelliferae and is native to the Mediterranean countries. It is widely cultivated in the temperate countries where it is employed as a culinary plant for garnishing and seasoning. The leaves of the plant are dried and kept in air-tight bottles for seasoning during the winter.<sup>1</sup> The species is cultivated in Pakistan on a limited scale as garden plant especially in Quetta. Its seeds are used as a medicine by the local inhabitants. The species is an aperative, carminative, stimulant and diuretic. The leaves of the plant are used for flavouring soups and foods. The seeds of the species contain an essential oil which is responsible for the typical odour and flavour of Parsley.

The present investigations have been chiefly called for firstly to understand the chemistry of the locally cultivated Parsley and secondly to determine the relative status of the indigenous oil and the oils of the species grown elsewhere in the world. These studies have been carried for the first time in so far as the Pakistani species is concerned.

#### Experimental

**Materials and Methods.** For the present studies, the seeds of the plant were purchased from the Quetta market. The essential oil from the crushed material was recovered by dry steam distillation according to the standard procedure.<sup>2</sup> The essential oil was obtained in two separate layers namely the heavy oil (0.45%) which formed the bottom layer and the light oil (1.29%) which floated as the upper layer of the distillate. The two layers were combined and the resultant oil was studied for its physico-chemical properties and chemical composition. The general methods employed for these studies have been described in our earlier communications.<sup>2,3</sup> Besides these methods of analysis, a time and temperature programmed gas-liquid chromatography coupled with mass spectrometry was used for the identification and estimation of the various components of the oil.

**Chromatographic Analysis of the Oil.** The oil was fractionated into hydrocarbons and oxygenated components by column chromatography using silica gel as an adsorbent. The hydro-carbon fraction, as eluted from the column with n-hexane, was resolved into individual components by GLC using a copper column (3m x 3mm) packed with 20% polyethylene glycol succinate on celite (60 - 80 mesh), nitrogen as the carrier gas and flame ionisation detector. The column was operated at 110° and 170° for the resolution of monoterpenes and sesquiterpenes respectively. Individual components of

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the oil were separated from the column with progressively increasing proportions (1-20%) of diethyl ether in n-hexane and the major pure components, such as myristicin, elemicin, 1-allyl-2,3,4,5-tetramethoxybenzene, piperitone,  $\alpha$ -terpineol etc., thus obtained were identified by GLC and IR comparison method. However, the minor components consisting of a mixture of aldehydes and ketones could not be separated by this method. The oil was, therefore, resolved as such by time and temperature programmed GLC using a Varian Gas Chromatograph (2100) with a flame ionisation detector and the various components were identified from their mass spectra. The glass column (100  $\times$  0.5mm) of the chromatograph was packed with SE-30 and its temperature was programmed from 70<sup>o</sup> to 180<sup>o</sup> at the rate of 2<sup>o</sup>/min.

### Results

The physico-chemical values and the chemical composition of the essential oil are recorded in Tables 1 and 2. Fig.1 shows the programmed chromatogram of the essential oil of *Peteroselinum crispum*.

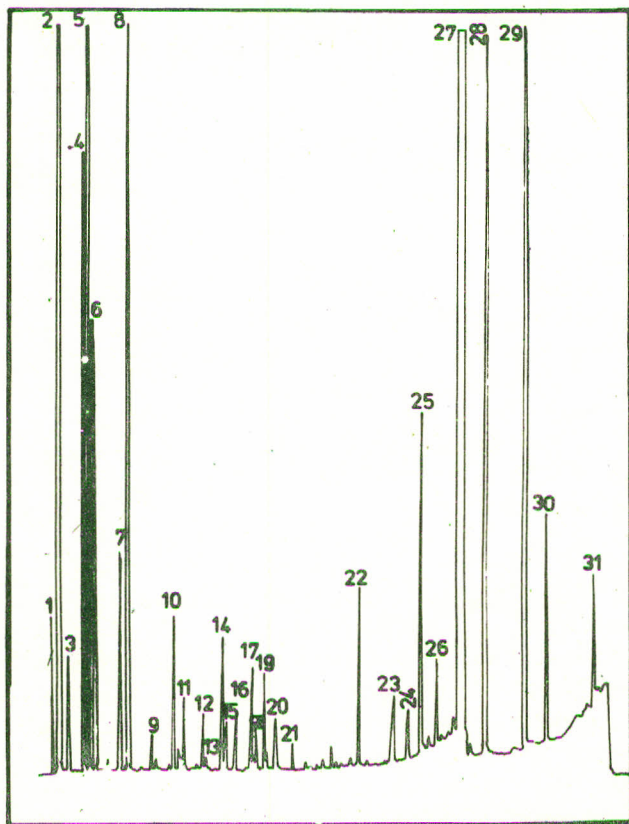


Fig. 1. Showing time and temperature programmed GLC of the essential oil of *Peteroselinum crispum*.

TABLE 1. PHYSICO-CHEMICAL VALUES OF THE ESSENTIAL OIL OF *Peteroselinum crispum* SEEDS.

Distillation period	8 hr
Yield of the oil	1.93%
Specific gravity	0.9947 <sup>30</sup>
Refractive index	1.5340 <sup>30</sup>
Optical rotation	-120 <sup>o</sup> 14'30
Acid value	0.48
Ester value	1.14

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

TABLE 2. PERCENTAGE COMPOSITION OF THE ESSENTIAL OIL OF *Peteroselinum crispum* SEEDS BY PROGRAMMED GLC.

Components	Percentage
1. $\alpha$ -Thujene	0.26
2. $\alpha$ -Pinene	24.85
3. Camphene	0.19
4. Sabinene	1.04
5. $\beta$ -Pinene	20.39
6. Myrcene	0.52
7. <i>p</i> -Cymene	0.46
8. (+) <i>m</i> -Mentha-1( )-8-diene	5.64
9. Myrtenal	0.06
10. 1- <i>p</i> -Menthen-9-al	0.38
11. Citronellal	0.18
12. Unknown aldehyde/ketone	0.27
13. Santinone	0.05
14. Unknown ketone	0.30
15. Pinocamphone	0.21
16. Unknown ketone	0.19
17. Unknown ketone	0.10
18. Campherone	0.27
19. Piperitone	0.25
20. $\alpha$ -Terpineol	0.15
21. Isomyrcenol	0.12
22. $\beta$ -Bisabolene	0.53
23. $\beta$ -Caryophyllene	0.29
24. Unknown sesquiterpene	0.22
25. $\beta$ -Farnesene	1.42
26. Unknown sesquiterpene	0.53
27. Myristicin	30.12
28. Elemicin	4.27
29. 1-Allyl-2,3,4,5-tetramethoxybenzene	5.56
30. Unknown phenol ether	0.79
31. Apiole	0.39

### Discussion

The essential oil, steam distilled from the seed of *Peteroselinum crispum* is quite sweet to smell. In the

hydrocarbon fraction of the Parsley seed essential oil, studied earlier by chemical method,<sup>4</sup> only one monoterpene namely  $\alpha$ -pinene was identified. In the present studies, while using time and temperature programmed GLC coupled with mass spectrometry, we are able to resolve this fraction into eight monoterpenes and five sesquiterpenes. These terpenes have been identified from the mass spectra results as well as by comparison with their standard samples.  $\alpha$ ,  $\beta$ -pinenes constituted a major portion of the hydrocarbon fraction.

Earlier work<sup>4</sup> on the chemical composition of the Parsley essential oil has indicated the presence of aldehydes, ketones and alcohols. We have, however, resolved this fraction into thirteen compounds including three aldehydes, eight ketones and two alcohols; out of which nine compounds have been identified (Table 2).

According to the earlier report,<sup>4</sup> a large portion of the Parsley essential oil was found to consist of myristicin, apiol and 1-allyl-2,3,4,5-tetra-methoxybenzene. Our oil contains about 41% of these compounds whereof their percentage in the French oil has not been indicated. Besides the earlier reported phenolic ethers, we are able to identify elemicin and another unidentified phenol ether in the Pakistani oil.

Qualitatively, the Pakistani Parsley essential oil is comparable with the one produced in France.<sup>4</sup> Both the oils contain myristicin as the major constituent. The

amount of apiol in our oil is rather small. The presence of elemicin in the oil is a new finding.

The present studies have, nevertheless shown good resemblance in the chemical composition of the oil with the one produced in France.<sup>4</sup> However, our work has not only indicated a much more detailed analysis of the Pakistani oil for the first time, but it has also extended the number of the components constituting the Parsley oil as a whole.

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