

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

Part XXXI. Wild *Daucus carota* (Carrot) Seed Oil

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(Received March 20, 1979)

Abstract. The essential oil steam distilled from the seeds of *Daucus carota*, grown wild in Pakistan, has been studied with respect to its physico-chemical values and chemical composition. The oil obtained in 0.8% yield has been shown to contain α -thujene (0.31%), α -pinene (0.31%), camphene (4.43%), β -pinene (1.11%), β -phellandrene (4.42%), limonene (0.66%), β -caryophyllene (0.59%), β -bisabolene (0.95%), unknown sesquiterpene (4.67%), geranyl acetate (6.63%), terpinyl acetate (18.65%), bornyl acetate (5.65%), carotol (36.34%), daucol (13.40%) and a mixture of coumarins with tarry material (1.58%). Although the major components of the oil, under discussion, are essentially the same as those of the cultivated species of *Daucus carota* yet the presence of esters, particularly terpinyl acetate in such a large amount in the former is interesting new finding.

Introduction

The physico-chemical investigations on the essential oil of the three varieties of *Daucus carota* cultivated in Pakistan, have already been communicated in Part IX of this series.¹ The present work deals with the physico-chemical evaluation of the essential oil recovered from the seeds of *Daucus carota* grown wild in the Neelum Valley of Azad Kashmir with a view to highlighting the quality and chemistry of the essential oil to exploiting the seeds of the species or its essential oil commercially.

No information is available as yet, regarding the utilisation of this species. The plant is usually grazed by animals. The roots of the wild growing *Daucus carota* are comparatively much smaller than those of the commonly cultivated species.

Experimental

Materials and Methods. The seeds of the *Daucus carota* were hand-collected from Neelum Valley and cultivated in the PCSIR Laboratories, Lahore to obtain enough material for purposeful chemical analysis. The essential oil from the crushed seeds was recovered by dry steam distillation.² The general methods employed for these studies have been described in our earlier publications.^{2,3}

Chromatographic Analysis of the Oil. As usual, the oil was fractionated into hydrocarbons and oxygenated components by column chromatography using activated silica gel as an adsorbent. The hydrocarbon fraction of the oil as eluted from the column with n-hexane, was

further resolved into individual components by GLC using a column packed with SE-30, nitrogen as the carrier gas and flame ionisation detector. The column temperature was maintained at 110° and 170° for the resolution and identification of monoterpenes and sesquiterpenes respectively. The oxygenated components of the oil recovered from the column with progressively increasing proportion (1-50%) of diethyl ether in n-hexane, were identified by TLC, IR and GLC comparison with their standard samples. The oil was also compared, by GLC, with the essential oil of the red variety of the cultivated seed of *Daucus carota*.¹

Results

The percentage yield, physico-chemical values and the chemical composition of the essential oil of the wild growing *Daucus carota* and its comparison with the essential oil obtained from the cultivated red variety of *Daucus carota* are recorded in Tables 1 and 2.

Discussion

The essential oil of the wild *Daucus carota* possesses a quite pleasant smell. Its chemical composition differs from that of the oil obtained from the commonly cultivated *Daucus carota*. The wild carrot seed essential oil contains terpinyl acetate, carotol and daucol as the major oxygenated components while only carotol is the major constituent of the cultivated species.¹

The physico-chemical values of the cultivated and wild species are also different from each other (Table 1)

TABLE 1. PERCENTAGE YIELD AND PHYSICO-CHEMICAL VALUES OF THE ESSENTIAL OILS RECOVERED FROM THE WILD AND CULTIVATED RED VARIETY OF *Daucus carota* SEEDS.

Properties	Wild carrot	Cultivated red carrot ¹
Distillation period (hr)	8	10
Yield (%)	0.80	2.10
Specific gravity	0.9390 ³²	0.9016 ²¹
Refractive index	1.5325 ³²	1.4160 ²¹
Optical rotation	-11° 54' ³²	+14° 45' ²¹
Acid value	0.95	1.12
Ester value	14.80	3.40

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

TABLE 2. PERCENTAGE COMPOSITION OF THE ESSENTIAL OIL OF THE WILD AND CULTIVATED RED VARIETY OF *Daucus carota* SEED.

Component	Wild carrot (%)	Cultivated red variety carrot (%)
α -Thujene	0.31	—
α -Pinene	0.31	1.15
Camphene	4.43	8.08
β -Pinene	1.11	—
Myrcene	—	1.40
β -Phellandrene	4.42	—
Δ^3 -Carene	—	0.30
Limonene	0.66	2.00
β -Caryophyllene	0.59	2.14
β -Bisabolene	0.95	7.25
Unknown sesquiterpene	4.67	11.67
β -Selinene	—	4.10
Geranyl acetate	6.63	—
Terpinyl acetate	18.95	—
Bornyl acetate	5.65	—
Carotol	36.34	62.80
Daucol	13.40	1.50
Mixture of coumarins	1.58	2.91

The major difference being in the optical rotation of the two oils. The oil from the cultivated species of all the three varieties have positive value of optical rotation while the oil from the wild species possesses negative optical rotation. This difference, is probably, due to the presence of terpinyl acetate in the wild growing species.

The ester value of the oil under discussion is also higher than the cultivated *Daucus carota* oil which fact confirms the presence of large amount of esters in the essential oil of the wild growing species.

The presence of terpinyl acetate in the oil has enhanced its flavour and made it more suitable to be used in perfumery and cosmetics. The amount of daucol in the wild carrot oil is larger than the cultivated species while the amount of the sesquiterpenic alcohol, carotol, is smaller in the essential oil of the former than in the latter.

The oil from the wild *Daucus carota* can find a good position in perfumery even though its yield is lower than that of the cultivated species. It is also worthwhile to point out that the wild species of *Daucus carota* has been successfully cultivated in the PCSIR Laboratories, Lahore for the first time. On the basis of the good quality it can become an item of commerce.

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

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

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