

PHYTOCHEMICAL DIFFERENTIATION IN *PEUCEDANUM CERVARIA* (L.) LAPEYR.

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RESUMEN.—Los análisis realizados por los autores en los aceites esenciales del fruto de *Peucedanum cervaria* procedentes del Sur de Alemania y del Noreste de España muestran la presencia de dos quimiotipos; éstos se caracterizan por la presencia (España) o la ausencia de 3-caroteno respectivamente.

SUMMARY.—Analyses of the essential fruit oils of *Peucedanum cervaria* from stands in southern Germany and north-eastern Spain indicate the occurrence of two chemotypes, which are characterized by the presence (Spain) or absence of 3-carene, respectively.

INTRODUCTION

Peucedanum cervaria (L.) Lapeyr. is one of the central European *Peucedanum* species, with an area of distribution extending westward to northern Spain and including wide parts of the Apennine and Balkan peninsulas in the south (1). Fruits and roots of *Peucedanum cervaria* have been in medical and veterinary use from Dioscorides' times to the 19th century (2,3). However, there is only initial knowledge about the secondary products of the plant. Only a few coumarins (4), furanocoumarins (5), flavonoids (6) and three monoterpenes (7) are recorded.

In the course of chemotaxonomic studies in the genus *Peucedanum*, we analysed the volatile constituents of *Peucedanum cervaria*. The analysis of the essential oils of the various parts of cultivated plants showed, that the essential root oil is composed almost exclusively (98%) of monoterpene hydrocarbons with α -pinene (90%) as the main constituent (8). The essential oils of the aerial parts of the plants differ from the root oil by larger quantities of higher boiling constituents. Qualitatively the essential oils from stems, leaves and young and mature fruits are nearly identical (9). Thus, comparative studies on the variation of the composition of the volatile constituents of *Peucedanum*

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cervaria can be based on the investigation of the essential oils from one of the aerial plant parts. Since the fruits contain a relatively high amount of essential oil (and are easy to handle) we concentrated on the essential fruit oils.

PLANT MATERIAL

Fruits of *Peucedanum cervaria* were collected in September/October 1986 from natural stands in northern Spain (near Lumbier, Jaca, Biéscas) and in southern Germany as well as from plants cultivated in the Botanical Garden of Würzburg.

ANALYSIS OF ESSENTIAL OILS

The essential oil was obtained within a week after collection by hydrodistillation of the fruits with a receiver as used by the European Pharmacopoeia for determining volatile oil in drugs. The oils were collected in n-pentane, and the solutions were stored in a refrigerator until analysis.

Gaschromatography

Gaschromatograph: Fractovap 2900 with FID (Carlo Erba Strumentazione).
Column: 50m WCOT glass capillary WG 11 (Werner Günther Analysentechnik).
Carrier Gas: nitrogen 1.5 ml/min.
Column Temperature: 7 min 70°C; 70°-200°C (3°C/min.); 200° C isothermal.
Injection Port: 200°.
Detector Oven: 220°.

IR-Spectrometry

Nicolet S-MX FTIR-spectrometer.
0.015 mm film between KBr plates.

RESULTS

The compounds identified in *Peucedanum cervaria* fruits are listed in table I. These 26 compounds, belonging mainly to the monoterpenes, represent 92 to 98 % of the individual investigated oils, which are characterized by a high content of monoterpene hydrocarbons (more than 85 %). Main constituent in all samples is sabinene, representing 30 to 60%, which is followed by α -pinene/ α -thujene (6-18 %) and β -pinene (2-16 %). The remainder consists of a variety of additional monoterpene hydrocarbons, oxygenated monoterpenoids and sesquiterpene hydrocarbons, which are found in more or less small amounts.

Independent from these general characteristics of the essential oils, a clear differentiation into two groups is visible. The three samples from plant populations in north-eastern Spain (c, d, e) contain a considerable amount of the bicyclic monoterpene hydrocarbon 3-carene, whereas in the samples from southern Germany (a, b) 3-carene occurs only as a trace component (table I) or is lacking at all (unpublished results).

DISCUSSION

Any interpretation of differences in the quantitative composition of essential oils derived from various plant populations has to take in account the variability in the amount of the individual constituents. In the case of *Peucedanum cervaria*, our comparative analysis of the essential fruit oils of two geographically separated populations in five

subsequent years (unpubl. data) showed very clearly, that the percentages of low boiling constituents like α -pinene and β -pinene vary in different years. However, the occurrence or virtual absence of a particular compound is a constant character. Thus we conclude, that the observed differences in the amount of 3-carene in samples collected in the same year as listed in table I do not reflect a percentual fluctuation, but represent two chemotypes. Since further samples of essential oils from the fruits of *Peucedanum cervaria* collected in southern Germany and in the southern Alps are all characterized by the absence of 3-carene, a differentiation into two geographically separated chemotypes seems to be indicated.

Table I. Components of *Peucedanum cervaria* fruit oil.

Compounds	Percentages**				
	(a)	(b)	(c)	(d)	(e)
α -Pinene/ α -Thujene*	6,01	12,82	15,50	13,52	18,52
Camphene	0,09	0,32	0,12	0,08	0,12
β -Pinene	6,08	15,77	5,77	1,87	3,45
Sabinene	59,45	43,07	48,50	57,24	31,62
3-Carene	0,02	0,02	5,35	13,28	12,61
Myrcene	2,28	3,41	2,62	2,85	2,99
α -Phellandrene	6,14	0,98	7,01	1,01	5,04
α -Terpinene	1,06	0,18	0,42	0,37	0,35
Limonene	1,72	3,43	6,21	1,60	12,19
β -Phellandrene/1,8-Cineole*	2,09	2,42	1,70	1,98	2,25
cis-Ocimene	0,01	0,02	0,02	0,17	0,28
γ -Terpinene	1,83	0,35	0,73	0,61	0,50
trans-Ocimene	0,01	0,04	0,13	0,18	0,18
p-Cymene	1,53	3,17	1,17	0,17	1,43
Terpinolene	0,44	0,12	0,42	0,70	0,63
trans-Thujanol-4	1,69	0,62	0,45	0,38	0,43
β -Bourbonene	0,30	0,18	0,06	traces	0,13
cis-Thujanol-4	0,75	0,26	0,24	0,26	0,27
Chrysanthylacetate (?)	0,33	0,98	traces	traces	traces
Terpinen-4-ol/ β -Carophyllene*	4,43	0,75	1,35	1,13	1,00
cis-Verbenol	traces	2,04	0,05	0,04	0,12
trans-Verbenol	traces	1,33	0,10	0,12	0,33
Germacrene-D	0,15	0,16	0,13	0,11	0,30
Total	96,41	92,44	98,05	97,67	94,74

** Percentages are based on computer calculated area normalization.

* Small amounts only

Oils a, b of plant material from southern Germany; oils c, d, e of plant material from north-eastern Spain.

Recently, a pronounced phytochemic and taxonomic west-east-differentiation has been found in *Molopospermum peloponnesiacum* (10, 11). In the genus *Peucedanum*, too, similar infra- and inter-specific differentiations in morphological characters are known; e.g. in *Peucedanum officinale* L. or in *Peucedanum alsaticum* L./*P. venetum* (Sprengel) Koch (1, 12). The investigated populations of *Peucedanum cervaria* in Spain have been discussed as belonging to a morphologically distinctive spanish infrageneric type (13); the results of our study support this opinion.

However, to get a better insight in the infrageneric pattern of differentiation, further investigations are necessary in the whole area of distribution of *Peucedanum cervaria*.

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