THE SEED OILS OF SOME SPECIES OF THE FAMILY CRUCIFERAE

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Many plants of the family Cruciferae have seeds which contain a considerable amount of oil, and this is utilized in various ways [1]. In recent years, the oil of the seeds of Crambe abyssinica Hochst. has been widely studied. Abroad, the oil is obtained by an industrial method and is refined, bleached, and hydrogenated without difficulty [2]. The majority of species of Crambe (colewort), which can readily be cultivated to give high crop yields [1, 3-5], can also be used as melliferous, starch-bearing green fodder, or as decorative plants [1, 5-7].

The oil of Crambe pontica Stev. has been little studied. We have investigated the oil of this plant and also the oils of Cakile maritima (L.) Scop., Sisymbrium altissimum L. (tumblemustard), Sisymbrium Loeselii (L.), Descurainia Sophia (L.) Schur. (flixweed tansymustard), Erysimum cheiranthoides L. (treacle erysimum), and Brassica armoraciodes Crern. [8].

Particular attention is merited by Crambe pontica and Sisymbrium Loeselii, the yield of whose seeds amounts to 20 centners per ha, and by treacle erysimum, from whose seeds cardiac glycosides are obtained,

TABLE 1. Physicochemical Characteristics of the Oils

Index	Cakile maritima		Sisymbrium altissimum		Sisymbrium Loeselii	
	author's results	literature figures [10]	author's results	lit. figs. [10]	author's results	lit. figs. [11]
Oil content of the seeds, %	40,28	44	30,72	35	32,25	30
Color, on the iodine scale	40	—	15	—	20	—
Refractive index, n_D^{20}	1,4766	1,4666	1,4789	1,4710	1,4770	—
Relative viscosity E_{20}°	9,23	—	8,28	—	8,17	—
Acid No., mg KOH	1,26	—	1,33	—	2,42	2,8
Saponification No., mg KOH	184,90	—	178.71	—	184,86	183,3
Iodine No., % I_2	131,78	114	159,93	150	130,50	142,4
Phosphatide content, %	0,70	—	0,26	—	0,87	—

TABLE 1 (continued)

Index	Descurainia Sophia		Erysimum cheiranthoides		Brassica armoraciodes	Crambe pontica	
	author's results	lit. figs. [11-12]	author's results	lit. figs. [11-13]		author's results	lit. figs. [9]
Oil content of the seeds, %	30,79	28—35	40,21	21—43	32,22	41,71	40
Color, on the iodine scale	20	—	25	—	25	40	—
Refractive index, n_D^{20}	1,4795	1,4712	1,4773	1,4795	1,4770	1,4739	—
Relative viscosity E_{20}°	7,45	—	9,15	—	9,45	11,27	
Acid No., mg KOH	2,57	3,1	1,13	0,73	2,34	3,12	2,95
Saponification No., mg KOH	174,69	184—186	182,35	178,3	189,02	185,22	170,0
Iodine No., % I_2	150,12	141—158	128,86	124,0	129,18	109,60	111,5
Phosphatide content, %	0,15	—	0,05	—	1,20	—	—

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TABLE 2. Fatty Acid Compositions of the Oils

Acid, %*	Cakile maritima		Sisymbrium altissimum		Sisymbrium Loeselii	Descurainia Sophia		Erysimum cheiranthoides		Brassica armoracioides	Crambe pontica
	author's results	lit. figs. [10]	author's results	lit. figs. [10]		author's results	lit. figs. [12]	author's results	lit. figs. [13]		
$C_{14:0}$	Traces	—	Traces	—	Traces	Traces	0,1	Traces	Traces	Traces	Traces
$C_{16:0}$	4,62	6	6,36	6	7,35	7,45	2	3,96	4,8	4,76	1,38
$C_{16:1}$	0,30	—	0,34	—	0,53	0,48	0,5	0,48	Traces	0,54	Traces
$C_{18:0}$	2,25	2	1,77	1	1,94	1,86	0,5	3,51	1,6	1,69	0,46
$C_{18:1}$	17,31	17	8,99	12	10,55	11,20	18	8,66	4,2	13,83	22,25
$C_{18:2}$	20,11	19	12,25	10	18,38	16,35	11	25,16	30,6	20,75	20,30
$C_{18:3}$	25,87	16	40,67	43	34,25	46,02	4	27,71		50,98	8,27
$C_{20:0}$	8,56	1	8,64	1	7,77	8,28	1	7,16	45	5,82	17,49
$C_{20:1}$	0,97	5	0,82	8	1,18	0,89	2	1,30		0,84	1,44
$C_{20:2}$	Traces	—	1,09	—	0,89	0,72	—	1,79	—	Traces	—
$C_{22:0}$	—	5	Traces	0,7	Traces	Traces	1		—	Traces	—
$C_{22:1}$	18,66	26	19,07	14	17,15	6,45	59	19,07	12,3	10,79	28,41
$C_{22:2}$	Traces	—	—	—	Traces	—	1	0,44	—	—	Traces
$C_{24:0}$	1,35	—	Traces	—	—	—	—	0,76	—	—	—
$C_{24:1}$	—	1	—	0,7	—	—	—	—	—	—	—
Others	—	0,9	—	2,4	—	—	—	—	—	—	—

*Symbols for the acids: The number in the index before the colon is the number of carbon atoms in the chain and the number after the colon is the number of double bonds in the molecule.

while its oils can be used for the manufacture of drying oils and soaps [9]. The oils of Crambe pontica, Sisymbrium Loeselii, and Descurainia Sophia can also be used in the manufacture of soaps [9].

The physicochemical indices of the oils considered (Table 1) differ little from those given in the literature.

Their fatty acid compositions (Table 2) were determined by gas-liquid chromatography on a model 4 Tswett chromatograph with a DIP-1 flame-ionization detector. The temperature of the thermostat (for the columns) was 193°C and that of the evaporator, 300°C. The length of the column was 2 m and the diameter, 4 mm. The support for the liquid phase was Celite 545 (40-60 mesh), and the liquid phase was diethylene glycol succinate (10%). The carrier gas was argon (at 60 ml/min). The paper feed rate was 400 mm/h. The volume of the sample introduced was 0.2-0.1 μl. To maintain the flame in the detector, hydrogen and air were fed in a ratio of 1:10 (2 liters/h and 20 liters/h, respectively).

The fatty acids were identified by comparing chromatograms of their methyl esters with those of known fatty acids. The presence of arachidic acid was established by the chromatography of groundnut oil and that of erucic acid by the chromatography of mustard oil; eicosadienoic and eicosenoic acids were identified from literature information [10], and the remaining acids were known from their presence in all oils and fats of animal origin.

No marked differences between the fatty acid compositions of the oils studied and those given in the literature were found. There was a difference only in the proportions of erucic and linolenic acids in the oil of Descurainia Sophia caused by the time and place of the gathering of the seeds and by ecological factors.

EXPERIMENTAL

The seeds were collected in July-August in the territory of the Zaporozhe oblast. The comminuted seeds were extracted with petroleum ether (bp 40-60°C). The physicochemical indices were determined by known methods [14]. The methyl esters of the fatty acids were obtained as described in the literature [14].

SUMMARY

The physicochemical properties of the oils of the seeds of seven plants of the family Cruciferae – Cakile maritima, Sisymbrium altissimum, Sisymbrium Loeselii, Descurainia Sophia, Erysimum cheiranthoides, Brassica amoracioides and Crambe pontica – have been studied and their fatty acid compositions have been determined. The results obtained showed no marked differences from those given in the literature.

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