OILS OF THREE REPRESENTATIVES OF THE FAMILY Cruciferae. II.*

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We have investigated the oils of the seeds of Lepidium sativum (gardencress pepperweed), Eruca sativa (rocket-salad), and Thlaspi arvense (field pennycress) collected in the experimental field of the Zaporozh'e Medical Institute in 1971. As potential oil-yielding plants they have long been attracting the attention of investigators. L. sativum and E. sativa are cultivated in Europe and Asia [2]. The oil of Th. arvense can be used as a fuel, as a lubricant for machine parts, for soap boiling, and as an edible oil [3, 4]. The oil of E. sativa possesses antibacterial properties in relation to various microorganisms, with a maximum activity against Escherichia coli, and the unsaponifiable substances of the Eruca oil, in experiments on mice, exhibit an anesthetizing effect [5]. The oil cake from Th. arvense resembles rapeseed cake and is readily eaten by cattle [6, 7]. Under conditions of cultivation, the yields of seeds of the plants studied are: L. sativum – 5.8 centners/ha [8], E. sativa – 6.6-22.7 centners/ha [6, 8, 9], and Th. arvense – 10-12 centners/ha [3, 7].

The weights of 1000 seeds are 2.00 g for L. sativum, 2.26 g for E. sativa, and 0.79 g for Th. arvense.

Table 1 gives some physicochemical properties of the oils and their fatty acids. The compositions of the fatty acids determined by gas–liquid chromatography [10] are given in Table 2. The oil contents of the seeds and the physicochemical properties of the oils differ slightly from those given in the literature, but agree best with the results of Bulgarian workers [8].

Table 2 shows that the amount of linoleic acid ($C_{18:3}$) in the oil of L. sativum is almost twice as great as in the other two oils, and the amount of erucic acid is considerably less. The presence or absence of

* For communication I, see [1].

TABLE 1

Index	Lepidium sativum		Eruca sativa		Thlaspi arvense	
	oil	fatty acids	oil	fatty acids	oil	fatty acids
Oil content of the seeds, %	23,08	—	33,46	—	29,18	—
Color, on the iodine scale	35	—	20	—	40	—
Refractive index, n_D^{20}	1,4751	—	1,4730	—	1,4740	—
Relative viscosity, E_{20}^0	8,75	—	12,51	—	10,88	—
Acid No., mg KOH/g	1,08	—	0,99	—	2,49	—
Saponification No., mg KOH/g	181,36	—	174,67	—	172,03	—
Iodine No., % iodine	120,18	127,24	102,79	113,87	118,49	132,36
Thiocyanogen No., % iodine	85,03	89,63	81,12	83,48	73,59	77,54
Neutralization No., mg KOH/g	—	192,28	—	178,75	—	184,13
Mean mol. wt.	—	291,81	—	313,90	—	304,73
Reichert–Meissl No., %	1,21	—	1,10	—	1.87	—
Polenske No., %	0,18	—	0,35	—	0,52	—
Phosphatides, %	0,57	—	0,52	—	0,52	—

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TABLE 2

Acid, %	Lepidium sativum	Eruca sativa	Thlaspi arvense	Acid, %	Lepidium sativum	Eruca sativa	Thlaspi arvense
$C_{14:0}$	Traces	0,16	0,14	$C_{20:1}$	13,99	7,92	10,92
$C_{16:0}$	7,59	6,83	3,44	$C_{20:2}$	1,4	0,58	1,56
$C_{16:1}$	0,41	0,94	0,75	$C_{22:0}$		Traces	
$C_{18:0}$	2,59	1,25	0,49	$C_{22:1}$	4,71	37,18	23,40
$C_{18:1}$	31,36	13,94	14,97	$C_{22:2}$	—	0,56	Traces
$C_{18:2}$	7,15	12,05	25,74	$C_{24:0}$	—	1,67	1,32
$C_{18:3}$	30,80	16,92	17,27				

erucic acid in the oils of Cruciferae is a systematic characteristic [11]. Umarov et al. [12-16] have found erucic acid in many Cruciferae oils. In E. sativa [13] they found 19.52% of erucic acid, while we and other workers [8, 17-20] have found from 35.7 to 43.0%. These differences are probably due to the different climatic conditions of growth of the seeds. According to three papers [17, 21, 22], the oil of Th. arvense contains 35.3-38.0% of erucic acid. Only by ecological factors is it possible to explain the fact that the oils of Th. arvense seeds, collected in the territory of the USA, contain 49% of erucic acid according to Clopton and Triebold [23], 38% according to Mikolajszak et al. [17], and 19% according to Miller et al. [24].

Polish workers [25] found 40.48% of arachidic acid in the oil of L. sativum. Such an amount of arachidic acid ($C_{20:0}$) had not been observed in any of the seed oils of representatives of the family Cruciferae.

EXPERIMENTAL

The oils were obtained by extraction with petroleum ether (bp 40-60°C). The compositions of the oils were determined by known methods [26]. The methyl esters of the fatty acids were obtained by a handbook method [26].

SUMMARY

The physicochemical properties and fatty-acid composition of the oils of the seeds of Lepidium sativum, Eruca sativa, and Thlaspi arvense, with oil contents of 23.08%, 33.46%, and 29.18%, respectively, have been determined. The amounts of erucic acid, which is characteristic for Cruciferae, found were 4.71% in the oil of L. sativum, 37.18% in that of E. sativa, and 23.04% in that of Th. arvense.

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