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LIPIDS FROM *Crambe amabilis* AND *C. kotschyana* SEEDS GROWN WITH SALINE IRRIGATION WATER

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Lipids from Crambe amabilis *Butk. et Majlun and* C. kotschyana *Boiss. grown in the open in Uzbekistan in soil imported from the Aral Sea region were studied. It was found that the seed oil content decreased with increasing salinity of irrigation water with EC 1.5 up to 9.0 dS/m. The content of polar lipids increased. The content of unsaturated acids from C. amabilis neutral lipids was 94.74–97.46%;* C. kotschyana, *95.76–96.78%.*

Keywords: *Crambe amabilis*, *Crambe kotschyana*, fatty acids, neutral and polar lipids, carotinoids, water salinity.

In continuation of studies of lipids from seeds grown with saline irrigation water, we investigated lipids from *Crambe amabilis* Butk. et Majlun and *C. kotschyana* Boiss. (Cruciferae) seeds grown in the open in Uzbekistan in soil imported from the Aral Sea region.

Plants were irrigated with water having different salinity levels and EC values of 1.5, 3.0, 6.0, and 9.0 dS/m. Measured amounts of NaCl and $CaCl_2$ of the appropriate concentrations were added to the solutions. Also, plants were fed K, N, and P fertilizers because it is known that plants die in saline soils even if copious amounts of fertilizers are used.

The use of saline soil and marine water for irrigation is a very critical problem. This is evident from numerous publications on this topic in international journals [1–3]. Its solution would enable not only the production of additional raw material for the economy but also the improvement of the ecological situation in regions where saline desert soils contribute particulates to the air [4].

Table 1 presents data on the contents of neutral lipids (NL) (i.e., oil content), carotinoids, and polar lipids (PL) of *C. amabilis* and *C. kotschyana* seeds as functions of the irrigation-water salinity.

The oil content of seeds from both species decreases as the irrigation-water salinity increases. This agrees with the literature [5–7]. The carotinoid content in oil from the studied seeds increased as the irrigation-water salinity increased to EC 3.0 dS/m and then decreased for EC 6.0 and 9.0.

Also, the content of PL in seed oil of *C. amabilis* increased with increasing irrigation-water salinity. It decreased at first to 0.0916% in seed oil of *C. kotschyana* for EC 3.0 dS/m and then increased to 1.7478% for EC 9.0. Therefore, the amount of PL in essence increased with a decreased content of NL. This is a natural response to a stressful situation.

Table 2 presents the fatty-acid compositions of NL and PL from the studied seed samples.

It can be seen that the qualitative and quantitative fatty-acid compositions of NL and PL from the studied seeds are practically the same as those for the same plants grown under natural conditions [6, 8, 9]. NL include a trace quantity of saturated acids (2.54-4.26% for *C. amabilis*; 3.22–4.24, *C. kotschyana*) whereas PL contain a much larger amount of them (18.68–25.12 and 18.74–28.22, respectively). Unsaturated acids occur more in NL. Erucic acid, which is characteristic of fatty acids in oil of this family, is concentrated mainly in NL (up to 35.43%) although its content in NL decreases with increasing irrigation-water salinity except for EC 9.0 dS/m for *C. amabilis*, where its content increased from 31.96 to 33.32%.

The results indicate that the studied plants adapted to saline stress and that they can produce viable seeds with a high oil content.

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TABLE 1. Oil, Carotinoid, and Polar Lipid Contents of *C. amabilis* and *C. kotschyana* Seeds

Plant	EC, dS/m			
	1.5	3.0	6.0	9.0
		Seed oil content (neutral lipids), % of abs. dry mass		
C. amabilis	20.2608	19.7737	16.1563	14.6576
C. kotschyana	19.3843	18.3260	16.7933	14.7390
		Carotinoid content in oil, mg%		
C. amabilis	11.9916	13.0676	11.2240	10.5844
C. kotschyana	21.5451	21.6653	20.1322	18.7177
		Polar lipid content in seeds, % of abs. dry mass		
C. amabilis	0.9968	1.2190	1.3983	1.4431
C. kotschyana	1.5372	1.4456	1.6681	1.7478

TABLE 2. Fatty-Acid Composition of Neutral and Polar Lipids from *C. amabilis* and *C. kotschyana* Seeds, GC, mass%

EC, dS/m	Fatty acid											
	14:0	16:0	16:1	18:0	18:1	18:2	18:3	20:1	20:2	22:1	Total	
											sat.	unsat.
						Neutral						
						C. amabilis						
1.5	0.12	2.15	0.21	0.27	22.21	18.42	4.82	18.21	1.63	31.96	2.54	97.46
3.0	0.14	3.49	0.37	0.25	18.51	19.95	7.27	20.09	1.48	28.45	3.89	96.12
6.0	0.17	3.57	0.39	0.52	22.79	17.87	5.79	18.31	1.03	29.56	4.26	94.74
9.0	0.16	2.97	0.35	0.56	24.73	14.55	4.12	18.03	1.21	33.32	3.69	96.31
						C. kotschyana						
1.5	0.13	2.71	0.25	0.48	23.21	12.62	5.12	18.96	1.09	35.43	3.32	96.68
3.0	0.14	2.64	0.28	0.44	24.14	12.21	4.87	19.07	1.13	35.08	3.22	96.78
6.0	0.16	3.72	0.36	0.36	24.43	16.88	5.49	16.87	1.19	30.54	4.24	95.76
9.0	0.14	3.52	0.40	0.38	21.27	19.34	6.09	16.63	1.58	30.65	4.04	95.96
						Polar						
						C. amabilis						
1.5	0.37	17.41	0.92	0.90	24.65	30.14	7.27	7.47	0.95	9.92	18.68	81.32
3.0	0.53	22.45	1.05	0.67	17.82	35.45	12.51	4.32	1.24	3.96	23.65	76.35
6.0	0.27	20.59	0.87	1.07	26.43	32.98	8.10	4.40	1.22	4.07	21.93	78.07
9.0	0.34	22.82	1.19	1.96	22.58	31.22	7.98	3.87	1.53	6.51	25.12	74.88
						C. kotschyana						
1.5	0.26	17.90	1.02	0.58	25.63	33.40	12.23	5.21	1.14	2.63	18.74	81.26
3.0	0.35	18.04	1.00	0.71	27.57	29.40	11.21	5.18	1.13	5.41	19.10	80.90
6.0	0.33	21.54	0.85	0.85	23.40	35.76	10.57	3.40	0.66	2.64	22.72	77.28
9.0	0.37	26.59	1.19	1.26	19.90	32.85	10.38	3.58	0.76	3.12	28.22	71.78

EXPERIMENTAL

GC of fatty–acid methyl esters was carried out on a Chrom-5 instrument with a flame-ionization detector, steel column (2.5 m × 4 mm) packed with Reoplex-400 on Inerton N-AW (0.16–0.20 mm), thermostat temperature 190°C, and N_2 and H_2 flow rate 30 mL/min.

Hydrolysis of acyl-containing classes and isolation of fatty acids and their methylation were performed as before [10]. The carotinoid content was measured by the literature method [11].

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