FATTY ACIDS OF THE SURFACE LIPIDS OF MAIZE GRAIN OF THE ORDINARY AND LYSINE-RICH FORMS

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It is known that the grain of maize transformed by the opaque-2 mutation (o2/o2) is more susceptible to diseases than grain of the initial forms and has poorer storage properties [1].

The surface of seeds is a physical and chemical barrier protecting them from various harmful factors, including infection by pathogens [2]. Results have been obtained that indicate a leading role of certain fatty acids in the protective mechanisms of higher plants [3, 4]. Continuing a study of the lipid complex of the o2/o2 forms of maize grain [5], we have considered the qualitative composition and the ratio of the fatty acids of the surface lipids of the grain of four forms, initial and mutant with respect to the o2 gene. There is no information on the composition of the grain surface lipids of maize (Zea mays L.).

The total surface lipids were isolated as described in [6]; the initial material and the isolation of the fatty acids have been described in [5]. Gas-chromatographic analysis was carried out on a Chrom-5 chromatograph (Czechoslovakia) in a 3 mm × 2.5 m column filled with 5% of SP-2100 on Chromaton N-Super, 0.16-0.20 mm (Czechoslovakia) in a 40 ml/min current of the carrier gas, helium, with a flame-ionization detector, in a programmed temperature regime from 150°C to 250°C, the inlet temperature being 260°C; the fatty acid ratio was calculated relative to the $C_{14:0}$ component (Table 1).

TABLE 1. Ratio of the Fatty Acids in the Surface Lipids of Maize Grain Calculated Relative to the $C_{14:0}$ Content

Fatty acid	Wf 9 (1987)		W 1.. (1987)		W 64A (1987)		A 204 (1987)		A 204 (1987)	
	+/+	o2/o2	+/+	o2/o2	+/+	o2/o2	+/+	o2/o2	+/+	o2/o2
$C_{11:0}$	0,06	0,15	0,58	0,22	Tr..	Tr.	0,94	0,29	0,19	0,18
$C_{12:0}$	0,13	0,09	0,14	0,44	Tr.	0,13	1,4	0,23	0,24	0,13
$C_{13:0}$	0,04	0,02	Tr..	0,03	Tr.	0,06	Tr.	Tr.	Tr.	Tr.
$C_{14:1}$	0,07	0,09	Tr..	Tr.	0,27	Tr.	Tr.	Tr.	0,15	0,24
$C_{15:1}$	0,16	0,18	0,14	Tr..	0,37	0,22	0,20	0,12	0,5	0,48
$C_{15:0}$	0,65	0,50	0,70	0,89	0,37	1,02	0,65	0,65	0,81	0,90
$C_{16:1}$	1,26	1,74	0,64	1,29	6,02	1,97	1,44	2,98	3,51	3,98
$C_{16:0}$	4,06	3,15	3,63	5,40	7,57	5,54	9,8	8,05	8,17	6,43
$C_{17:0}$	0,32	0,55	0,48	0,60	1,11	2,02	1,32	1,19	1,01	2,82
$C_{18:1,2}$	10,30	3,91	5,4	2,90	19,37	8,84	17,84	6,31	10,51	5,58
$C_{18:0}$	1,43	1,16	0,99	2,36	2,55	2 54	5,6	1,38	2,94	1,75
$C_{19:0}$	0,03	0,06	0,13	0,22	0,70	0,59	0,48	0,58	0,81	0,82
$C_{20:0}$	0,25	0,24	0,18	0,24	0,63	0,64	1,33	0,22	0,69	0,69
$C_{21:0}$	0,12	0,11	0,13	0,24	0,35	0,29	0,81	1,08	0,46	0,39
$C_{22:0}$	3,76	3,04	2,4	1,3	6,17	6,87	7,29	4,05	2,38	8,95
$C_{23:0}$	0,18	0,14	0,12	0,20	0,79	0,41	0,39	0,92	1,04	1,16
$C_{24:1}$	0,55	0,06	Tr..	Tr..	Tr.	Tr.	5,8	0,81	Tr.	Tr.
$C_{24:0}$	2,48	1,37	1,18	0,85	4,20	3,61	6,2	1,55	2,88	2,96
$C_{25:0}$	1,87	2,04	1,09	0,60	12,56	3,11	2,48	2,17	5,00	2,45
$C_{26:0}$	0,91	0,39	0,43	0,2.	1,79	1,03	1,76	0,44	1,19	0,47
$C_{27:0}$	0,13	0,08	Tr.	Tr.	Tr.	Tr.	Tr.	Tr.	0,42	Tr.

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The seed coats of the initial forms contained 1.9-2.8 times more of the unsaturated C_{18} acids. A similar situation has been found in an investigation of the surface lipids of cottonseeds of two forms differing in susceptibility to the pathogenic fungus Verticillium dahliae Kleb. [6].

In samples of the o2/o2 mutant forms, with the exception of the A204 line, considerable falls in the levels of the $C_{24:1}$, $C_{25:0}$–$C_{27:0}$, and $C_{24:0}$ acids were detected. The only slight differences in the results for the 1986 and 1987 samples show that the features described above are independent of the year of reproduction.

Thus, the results that we have obtained confirm the role of fatty acids in the protective functions of the seed surface. The presence of changed ratios of fatty acids in the surface lipids of the o2/o2 maize grain and their presumable participation in the creation of the "high-lysine syndrome" – a hereditary disease of maize expressed in an increased level of lysine in the grain and, as a consequence, a deterioration of seed quality and a fall in crop yield [7] – is here shown for the first time.

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