INVESTIGATION OF THE LIPIDS OF TWO SPECIES OF *Alhagi*

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Camel's thorn — one of the most widely distributed plants of Central Asia — is widely used in folk medicine [1, 2].

We have investigated the acyl-containing lipids of camel's thorn seeds of two species: *Alhagi persarum* Boiss (gathered in Chimkent Province) and *Alhagi pseudalhagi* (gathered in the Surkhandar'ya Province).

The lipids were extracted from the comminuted seeds stagewise — with hexane, acetone, and chloroform–methanol (2:1). The yields of substances from the *A. persarum* and the *A. pseudalhagi* seeds on extraction with hexane were 2.3 and 2.3%, with acetone 0.4 and 0.5%, and with chloroform–methanol 2.0 and 1.5%, respectively. The extractive substances were deposited on a column of silica gel and were eluted with solvents as described in [3]. The fraction containing the free fatty acids (FFAs) were methylated with diazomethane (Table 1). Homogenous fractions of the individual classes of lipids were obtained by TLC rechromatography in the systems described in [3].

The bulk of the triacylglycerides (TAGs) passed into the hexane extract, and about 1% into the acetone and chloroform–methanol extracts, while the FFAs and diacylglycerides (DAGs) were detected only in the hexane fraction. The monoacylglycerides (MAGs) and sterol esters (SEs) were distributed between the three fractions. The glycolipids di- and monogalactosyldiacylglycerides (DGDGs and MDGDs) were detected only in the acetone fraction.

After the saponification of the acyl-containing lipids, the fatty acids were methylated with diazomethane and were identified by GLC (see Table 1).

The qualitative distribution of the lipids in the extracts and the sets of fatty acids were identical in the two species of camel's thorn. With an increase in the polarity of the solvents used, a tendency was observed for an increase in the degree of unsaturation in the fatty acids in the TAGs and the SEs. The DGDGs were characterized by an increased content of saturated fatty acids, represented mainly by palmitic, and the MDGDs by the reverse pattern. It must also be mentioned that the total degree of unsaturation in the *A. persarum* was higher than in the *A. pseudalhagi*.

Phospholipids (PLs) were isolated from the chloroform–methanol extract as described in [4]. The yield of phospholipids for *A. pseudalhagi* was 1.1%, and from *A. persarum* — 1.5% on the seeds.

The following were identified in the total material by the TLC method, on the basis of qualitative reactions and with the aid of markers: phosphatidyl choline (PC), phosphatidylinositol (PI), phosphatidylethanolamine (PE), phosphatidylglycerol (PG), phosphatidic acid (PA), N-acylphosphatidylethanolamine (N-acyl-PE), N-acyl-lyso-PE, and lyso-PC, the number of PLs in *A. persarum* being six and in *A. pseudalhagi* seven.

Enzymatic and alkaline hydrolysis and the working up and identification of the fatty acids were carried out as described in [4].

Details of the fatty acid compositions are given in Table 2.

In the PC and the PI, the unsaturated fatty acids were practically completely localized in the sn-2 position, while in the PE a redistribution of the 16:0 acid in the Sn-1 and Sn-2 positions was observed although the degree of unsaturation of the

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TABLE 1. Fatty Acid Compositions of the Lipids of Camel's Thorn Seeds

Lipid, % in extract	16:0	18:0	18:1	18:2	18:3	∑ П	∑ Н
			Alhagi persarum				
TAG (67%, h.e.)	12,0	1,1	17,0	69,1	0,8	13,1	86,9
TAG (0,8%, a.e.)	12,2	0,7	16,0	70,3	0,8	12,9	87,1
TAG (1,0%, c.m.e.)	9,7	—	16,4	73,1	0,8	9,7	90,3
DAG (8,8%, h.e.)	18,6	0,5	14,5	65,6	0,8	19,1	80,9
MAG (1,8%, h.e.)	21,5	2,3	17,6	57,1	1,5	23,8	76,2
MAG (0,8%, a.e.)	23,2	5,0	18,1	51,8	1,9	28,2	71,8
MAG (2,4%, cm.m.e.)	22,4	3,8	21,8	51,1	0,9	26,2	73,8
FFA (5,4%, h.e.)	19,1	0,5	14,8	64,6	1,0	19,6	80,4
SE (8,6%, h.e.)	32,2	1,5	18,3	44,3	3,7	33,7	66,3
SE (3,0%, a.e.)	22,1	5,5	0,9	68,6	2,8	27,7	72,3
SE (4,8%, c.m.e.)	19,4	1,5	24,5	53,6	1,2	20,9	79,1
DGDG (1,2%, a.e.)	46,8	5,7	15,6	25,0	6,9	52,5	47,5
MGDG (1,2%, a.e.)	23,7	2,1	15,0	43,7	15,5	25,8	74,2
			Alhagi pseudalhagi				
TAG (77%, h.e.)	16,1	1,3	15,9	65,9	0,9	17,4	82,6
TAG (0,7%, a.e.)	11,5	—	11,2	75,6	1,7	11,5	88,5
TAG (0,8%, c.m.e.)	12,0	0,5	12,5	74,2	0,8	12,0	88,0
DAG (9,4%, h.e.)	42,4	3,3	14,7	38,5	1,0	45,7	54,3
MAG (2,0%, h.e.)	25,2	3,2	17,3	53,2	1,1	28,4	71,6
MAG (0,6%, a.e.)	29,9	2,6	15,2	48,6	3,7	32,5	67,5
MAG (2,4%, c.m.e.)	23,6	2,3	14,6	57,9	1,6	25,9	74,1
FFA (3,3%, h.e.)	31,6	3,1	12,8	52,5	—	34,7	65,3
SE (4,1%, h.e.)	38,0	3,4	22,5	33,1	3,0	41,4	58,6
SE (5,2%, a.e.)	31,1	2,9	21,8	37,8	6,4	34,0	66,0
SE (4,6%, c.m.e.)	27,8	1,8	16,8	50,0	3,6	29,6	70,4
DGDG (3,9%, a.e.)	53,8	8,3	16,3	16,3	5,3	62,1	37,9
MGDG (5,2%, a.e.)	24,1	1,7	19,1	51,9	3,2	25,8	74,2

*h.e.) Hexane extract; a.e) acetone extract; c.m.e.) chloroform–methanol extract.

TABLE 2. Total and Positional Fatty Acid Compositions of the Phospholipids of the Seeds of Two Species of Camel's Thorn

PL	14:0	14:1	16:0	18:0	18:1	18:2	18:3	∑П	∑Н
					Alhagi persarum				
Total	—	—	13,0	0,4	19,6	65,7	1,3	13,4	86,6
PC Sn-1	—	—	25,7	0,8	23,2	49,7	0,6	26,5	73,5
Sn-2	—	—	0,3	—	16,0	81,7	2,0	0,3	99,7
Total	—	—	21,6	1,1	15,5	61,2	0,6	22,7	77,3
PE Sn-1	—	—	29,3	2,2	15,9	52,5	0,1	31,5	68,5
Sn-2	—	—	13,9	—	15,1	69,9	1,1	13,9	86,1
Total	—	—	37,1	0,4	7,0	53,5	2,0	37,5	62,5
PI Sn-1	—	—	73,6	0,8	4,1	19,3	2,2	74,4	25,6
Sn-2	—	—	0,6	—	9,9	87,7	1,8	0,6	99,4
PG	0,4	0,4	35,5	5,1	35,0	18,8	4,8	41,4	58,6
N-acyl-PE	0,2	0,2	25,7	2,0	16,0	53,8	2,1	28,1	71,9
N-acyl-lyso-PE	0,4	0,4	37,2	0,9	11,0	47,5	2,6	38,9	61,1
					Alhagi pseudalhagi				
Total	—	—	21,1	1,1	14,5	62,2	1,1	22,2	77,8
PC Sn-1	—	—	38,2	2,2	16,8	42,6	0,4	40,4	59,6
Sn-2	—	—	4,0	—	12,2	82,0	1,8	4,0	96,0
Total	—	—	29,4	3,2	11,3	54,8	1,3	32,6	67,6
PE Sn-1	—	—	33,0	3,5	10,4	51,8	1,3	36,5	63,5
Sn-2	—	—	25,8	2,9	12,2	57,8	1,3	28,7	71,3
Total	—	—	39,8	0,9	2,6	55,0	1,7	40,7	59,3
PI Sn-1	—	—	78,9	1,8	0,5	17,4	1,4	80,7	19,3
Sn-2	—	—	0,7	—	4,7	92,6	2,0	0,7	99,3
PA	2,4	1,9	52,4	8,1	19,5	11,6	3,8	64,8	35,2
PG	0,5	0,3	17,1	5,0	20,1	55,8	1,2	22,9	77,1
N-PE	0,3	0,3	27,3	0,9	20,5	49,8	0,9	28,8	71,2
Lyso-PC	0,4	0,4	38,3	1,9	11,7	45,1	2,2	41,0	59,0

PE molecule was higher than that of the PI molecule. The degree of unsaturation of the PLs of the *A. persarum* seeds proved to be higher than that of the PLs of the *A. pseudalhagi* seeds. We are the first to have observed such a strict positional distribution of the fatty acids in the PC and, particularly, the PI molecules in plant materials.

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