

LIPIDS AND LIPOPHILIC COMPONENTS FROM SEEDS OF THREE Boraginaceae SPECIES

N. K. Yuldasheva, N. T. Ul'chenko,
A. I. Glushenkova, and A. M. Nigmatullaev

UDC 547.916.665.33

In continuation of the search for lipid-bearers containing ω -3 and ω -6 acids, we studied lipids from seeds of *Lindelofia macrostyla*, *Trichodesma incanum*, and *Anchusa italica* (Boraginaceae) collected in Tashkent Oblast. These plants have attracted interest because many of their seed oils contain very active essential ω -3 and ω -6 fatty acids. Total neutral lipids were isolated by extraction with benzine (bp 72–85°C) in a Soxhlet apparatus. Bound lipids were extracted from the remaining pulp according to Folch [1].

Because a part of the NL was found in the bound fraction, they were separated from the latter by column chromatography with elution by CHCl_3 ; GL, by acetone; PL, by MeOH. The NL obtained from the bound fraction were combined with those previously extracted. The yield of NL from oil of *L. macrostyla* was 13.9%; from *T. incanum*, 10.8; from *A. italica*, 22.6.

The maximum content of NL was found in seed oil of *A. italica*. GL and PL dominated oil from *T. incanum* seeds.

NL from the three studied species contained hydrocarbons, triacylglycerides, esters of cyclic alcohols with fatty acids, free fatty acids, sterols, and diacylglycerides according to TLC on silica gel using hexane:Et₂O (4:1 and 1:1).

GL were analyzed by TLC on silica gel using $\text{CHCl}_3:(\text{CH}_3)_2\text{CO}:\text{MeOH}:\text{HOAc}:\text{H}_2\text{O}$ (65:20:10:10:3). It was found that GL from *L. macrostyla* seed oil consisted of sterolglycosides, esters of sterolglycosides, cerebrosides, esters of cerebrosides, digalactosyldiglycerides, and monogalactosyldiglycerides. GL from seed oil of *T. incanum* and *A. italica* had the same composition as that from *L. macrostyla* but did not contain cerebrosides and their esters.

Two-dimensional chromatography was used to separate PL. The first direction used $\text{CHCl}_3:\text{MeOH}:\text{NH}_4\text{OH}$ (25%) (65:25:5); the second, $\text{CHCl}_3:\text{MeOH}:\text{HOAc}:\text{H}_2\text{O}$ (14:5:1:1).

Phosphatidylcholines (PC), phosphatidylinositols (PI), phosphatidylethanolamines (PE), phosphatidic acids (PA), and *N*-acyl-lyso-phosphatidylethanolamines were observed in PL of *L. macrostyla* seed oil. PL from *T. incanum* and *A. italica* had the same composition with the exception of *N*-acyl-lyso-phosphatidylethanolamines.

The emulsions obtained after alkaline hydrolysis of NL, GL, and PL were decomposed by H_2SO_4 (10%). The released fatty acids were extracted with Et₂O, methylated by diazomethane, and analyzed by GC on a Chrom-2 instrument [2]. Table 1 lists the composition of the fatty acids.

It can be seen that the qualitative fatty-acid compositions of *L. macrostyla* and *T. incanum* seed oils were identical and consisted of 13 components whereas fatty acids from *A. italica* seed oil numbered 9 components.

The principal saturated acid was 16:0; unsaturated, 18:1 and 18:2. Furthermore, seed oil of *T. incanum* and *A. italica* also contained significant quantities of ω -6 and ω -3-octadecatrienoic acids.

TABLE 1. Fatty-Acid Composition of NL, GL, and PL of Seed Oil from Three *Boraginaceae* Species, GC, mass %*

Acid	<i>Lindelofia macrostyla</i>			<i>Trichodesma incanum</i>			<i>Anchusa italica</i>		
	NL 92.5	GL 5.2	PL 2.3	NL 87.4	GL 6.8	PL 5.8	NL 97.2	GL 1.2	PL 1.6
12:0	0.1	—	—	—	0.3	11.5	—	1.0	0.7
14:0	0.1	2.2	0.4	0.1	0.6	0.6	0.2	1.1	0.8
16:0	9.1	18.9	29.8	7.7	28.5	31.3	9.9	18.7	18.1
16:1	0.4	0.5	0.5	0.1	1.0	0.6	1.0	2.8	2.4
18:0	0.4	1.8	1.8	0.1	6.3	3.4	3.4	7.3	4.6
18:1	32.1	22.3	22.0	18.4	27.2	22.3	15.7	20.5	15.6
18:2	26.3	14.2	32.8	37.5	10.8	12.2	13.3	22.0	19.0
18:3 (6,9,12) ω -6	5.4	1.4	3.1	15.8	1.5	0.9	6.5	4.2	7.2
18:3 (9,12,15) ω -3	7.5	4.6	3.5	11.0	10.5	9.8	35.6	15.9	23.7
20:1+(18:4)	7.9	3.6	2.2	5.5	4.0	1.6	14.4	4.8	5.3
22:0	1.3	8.8	1.7	1.8	4.0	2.7	—	—	—
22:1	6.9	7.7	2.2	2.0	5.3	3.1	—	—	—
24:1	2.5	10.2	Tr.	Tr.	Tr.	—	—	—	—
$\Sigma_{\text{sat.}}$	11.0	35.5	33.7	9.7	39.7	49.5	13.5	29.8	26.8
$\Sigma_{\text{unsat.}}$	89.0	64.5	66.3	90.3	60.3	50.5	86.5	70.2	73.2

*Traces of 26:1 acid were observed in NL, GL, and PL of *Lindelofia macrostyla* seed oil; 22:2 acid was found (3.8%) in GL. GL and PL of *Anchusa italica* contained 10:0 acid (1.7 and 2.6%, respectively). Tr.: traces.

REFERENCES

1. M. Kates, *Techniques of Lipidology: Isolation, Analysis, and Identification of Lipids*, Elsevier, New York, 1972.
2. N. T. Ul'chenko and A. I. Glushenkova, *Khim. Prir. Soedin.*, 103 (2000).