PHOSPHOLIPID AND FATTY-ACID COMPOSITIONS OF HIGHER FUNGI

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The phospholipid and fatty-acid compositions of nine species of higher fungi have been investigated. In the various species studied the amount of total lipids ranged from 14 to 78 mg per gram dry weight. Phosphatidylcholine and phosphatidylethanolamine were found as the main classes of phospholipids. In addition to these, phosphatidylserine, phosphatidylinositol, phosphatidylglycerol, cardiolipin and lyso derivatives of phosphatidylcholine and phosphatidylethanolamine were also found. The main fatty acids were palmitic, oleic, and linoleic, their amount in some species reaching 90%; other acids were also found, but in small amounts.

The most complete information on the phospholipids of higher fungi is given in a number of reviews [1-3]. Judging from other publications [4-6] PEs and PCs were the main classes of phospholipids, and PSs, PIs, PGs, and DPGs were present as minor components. The fatty acids investigated in various species were not distinguished by great diversity.

We have investigated the composition of the PLs of previously unstudied species of fungi gathered in the basin of the River Volga. PC and PE were the dominating classes of PLs, the concentration of PC ranging from 19.0 to 49.6% and that of PE from 19.8 to 39.0% (Table 1). Lyso-PC (4.3-16.9%), lyso-PE (4.8-21.3%), DPG (0.3-12.2%), and PI (0.4-23.7%) were found in the majority of species. PG was found in only two species: Clytocibe inversa (2.1%) and Agaricus sylvaticus (9.3%). PC was likewise found only in certain species, and this in small amounts; only in two species (Agaricus arvensis and Laccaria amethystina) did its amount reach 8.7 and 8.6%, respectively.

The fatty-acid compositions of the fungi were not marked by great diversity. The main fatty acid was linoleic (18:2), the amount of which ranged from 18.32 to 90.93%. Individual fungi had high oleic acid (18:1) contents. Thus, in Laccaria amethystina its concentration was 32.62%, and in Clytocibe inversa 30.18% (Table 2). The odd 13:0, 15:0, and 17:0 acids were found in almost all the species, but these acids were minor components, except for Lycoperdon pusillum, in which 18.77% of the 17:0 acid was found. In the case of Coprinus comatus the 11:0, 12:0, iso-13:0, iso-14:0, and iso-15:0 acids were detected.

TABLE 1. Compositions of the Phospholipids of Higher Fungi (in percentages of the total lipid phosphorus)

Species	PS	PE	LPE	PG	DPG	PI	PC	LPC	TL
Agaricus arvensis Fr.	8,7	39,0	16,0	—	0,3	0,4	35,6	—	17,0
Agaricus silvaticus Secr.	—	20,7	17,7	9,3	7,0	16,0	19,0	10,3	14,0
Clytocibe inversa (Fr.) Quel.	—	32,2	11,7	2,1	1,8	7,5	34,7	10,0	40,0
Coprinus atramenthorius (Fr) Fr.	2,0	34,0	9,4	—	—	1,0	40,5	13,1	13,0
C. comatus (Fr.) S.F. Gray	1,4	27,0	4,8		2,4	23,7	33,5	7,2	30,4
Laccaria amethystina (Merat.) Murr.	8,6	19,8	8,6	—	12,2	9,2	35,5	6,1	35,0
Lactarius flexuosus (Fr.) S. Gray	—	22,7	21,3	—	1,6	—	49,6	4,8	40,0
Lycoperdon berlatum Pers.	1,4	35,0	7,1	—	0,7	9,7	41,8	4,3	20,0
L. pusillum Pers.	—	35,0	—	—	11,7	—	36,4	16,9	78,0

Abbreviations: TL) total lipids, mg/g dry weight; PS) Phosphatidylserine; PE) phosphatidylethanolamine; LPE) lyso-PE; PI) Phosphatidylinositol; DPG) cardiolipin; PG) phosphatidylglycerol; PC) phosphatidylcholine; LPC) lyso-PC.

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TABLE 2. Fatty-acid Compositions of the Total Lipid Extracts of Higher Fungi (amount, wt.%, GLC)

Species	14:0	15:0	16:0	16:1	17:0	18:0	18:1	18:2	18:3
A. arvensis[a]	Tr.	0,04	9,18	0,05	0,01	0,26	1,56	88,77	0,05
A. silvaticus[b]	0,05	—	19,91	—	0,17	0,35	3,00	76,52	—
C. inversa	0,01	0,03	3,77	0,02	0,03	0,15	30,18	65,70	0,11
C. atramenthorius[c]	0,19	0,66	18,96	—	—	2,30	3,87	73,95	—
C. comatus[d]	4,53	1,39	25,49	1,63	2,13	5,90	19,90	21,33	—
L. amethystina	0,02	0,02	9,03	0,02	—	0,07	11,07	79,75	0,02
L. fleuxuosus[e]	0,02	0,05	13,08	0,12	0,06	0,16	32,62	53,73	0,01
L. perlatum	Tr.	0,16	6,32	—	—	0,28	2,31	90,93	—
L. pusillum[f]	2,35	6,94	11,66	—	18,77	14,19	0,41	18,32	1,11

a C13:0—tr. C20:0+0,08%.
b C13:0—tr.
c C13:0—0,07%.
d C11:0—6,86%; C12:0—2,14%; C13:0—1,18%; Ciso-13:0—3,90%; Ciso-14:0—1,67%; Ciso-15:0—1,75%.
e C12:0—tr.; C13:0—0,02%; C15:1—0,01%; C20:0—0,02%; C20:1—0,07%.
f C12:0—0,25%; C13:0—0,63%; C20:0—14,61%; C20:1—6,70%.

Thus, the first investigations of the phospholipid and fatty-acid compositions of hgiher fungi gathered in the Volga basin have been made. A further study of the lipids of higher fungi with the aim of finding new biologically active substances appears extremely promising and encouraging.

EXPERIMENTAL

The higher fungi were gathered in the basin of the River Volga far from industrial enterprises. The lipids were extracted by the method of [10]. Amounts of phospholipids were determined according to [11]. Methyl esters of the fatty acids were analyzed by GLC and were identified as in [12].

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