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SHORT COMMUNICATION

# LIPID AND PIGMENT PATTERNS IN GERMINATING *POLYTRICHUM COMMUNE* SPORES

PIRJO KARUNEN

Department of Botany, University of Turku, Turku 2, Finland

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**Abstract**—Although there is some information on the lipid constituents in the leafy and woody parts of mosses[1] no attention—up until now—has been paid to the lipids in the moss spores even though mosses are of particular interest as they contain arachidonic acid.[2–4] The primary interest, in this study, is directed to the changes of the lipid and pigment patterns in germinating spores of *Polytrichum commune* Hedw. and detailed results of the study will be published later.

THE LIPIDS of moss spores were extracted with chloroform–methanol (2:1) and fractionated by using TLC. The spores contain triglycerides and sterol esters as major components as well as free fatty acids, sterols, diglycerides, monoglycerides, a so far unknown component (alkoxylipid?) and polar lipids as minor constituents. Preliminary studies of the qualitative nature of the polar glyco- and phospholipids were carried out on silica gel, and as solvent system chloroform–acetone–methanol–acetic acid–water (50:20:10:10:5)[5] was used as well as conventional colour reactions. Glyco- and phospholipids seemed to be the same as those found earlier in mosses.[1] Moreover, there was one spot on the chromatograms which gave typical Liebermann–Burchard colour reaction with an $R_f$ value close to that of sterol glycosides.

Quantitative changes in the amount of lipids during germination have been—up until now—determined by the weight of the amount of total lipid, that of triglycerides by quantitative IR spectrophotometry,[6] of chlorophylls a and b[7] and carotenoids[8] by spectrophotometry. The results of the determinations along with the dry weight during 72 hr of germination are listed in Table 1. In contrast to the leafy and woody parts of mosses, the prominent components in the spores were triglycerides (53·6% of total lipid). During the first 12 hr there was only a slight decrease in the amount of triglycerides as the spores seemed to have preferentially mobilized other lipids, probably sterol esters. At later stages triglycerides were metabolized more rapidly, until at 72 hr only 21·4% of the original amount remained. The turnover of total lipid was, however, only 24·3%. This is due to the

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increase in the amount of chlorophylls and carotenoids in later stages, as well as of polar lipids judging from the size of spots on the chromatograms.

TABLE 1. WEIGHT OF TOTAL LIPID, TRIGLYCERIDES, CHLOROPHYLLS a AND b AND CAROTENOIDS DURING 72 hr GERMINATION

| Germination (hr) | Dry wt. (mg) | Per 20·0 mg original spores: Total lipid (mg) | Triglycerides (mg) | Chlorophyll a (mg) | Chlorophyll b (mg) | Carotenoids (mg) |
|---|---|---|---|---|---|---|
| 0 | 19·41 ± 0·09 | 7·13 ± 0·06 | 3·83 ± 0·03 | 0·13 ± 0·00 | 0·08 ± 0·00 | 0·06 ± 0·00 |
| 1·5 | 18·30 ± 0·15 | 6·55 ± 0·06 | 3·66 ± 0·09 | 0·12 ± 0·00 | 0·07 ± 0·01 | 0·06 ± 0·00 |
| 3 | 17·73 ± 0·21 | 5·75 ± 0·11 | 3·63 ± 0·06 | 0·12 ± 0·00 | 0·08 ± 0·00 | 0·06 ± 0·00 |
| 6 | 18·15 ± 0·24 | 5·56 ± 0·11 | 3·63 ± 0·08 | 0·13 ± 0·00 | 0·08 ± 0·00 | 0·06 ± 0·00 |
| 12 | 18·59 ± 0·13 | 5·55 ± 0·10 | 3·49 ± 0·01 | 0·14 ± 0·00 | 0·08 ± 0·00 | 0·06 ± 0·00 |
| 24 | 22·17 ± 0·21 | 5·53 ± 0·07 | 2·98 ± 0·19 | 0·26 ± 0·00 | 0·15 ± 0·00 | 0·09 ± 0·00 |
| 48 | 28·70 ± 0·89 | 5·44 ± 0·13 | 1·22 ± 0·03 | 0·62 ± 0·01 | 0·35 ± 0·01 | 0·15 ± 0·00 |
| 72 | 35·10 ± 1·48 | 5·40 ± 0·12 | 0·82 ± 0·01 | 0·78 ± 0·02 | 0·56 ± 0·01 | 0·19 ± 0·01 |

Saponification and esterification[9] furnished the methyl esters of lipid fractions which were separated by TLC and GLC on columns containing EGSS-X, SE 30 and XE 60 as stationary phases. The main fatty acids in the triglyceride fraction were palmitic, oleic, linoleic and linolenic acids (Table 2). Odd-numbered fatty acids, not having been reported in mosses earlier,[1–4] were found in the minor constituents. A preliminary study in the other lipid classes revealed also some so far unknown fatty acids in mosses such as C 16:4, characteristic to some algae,[10–12] in the sterol ester fraction as well as some as yet unidentified components (perhaps unsaturated C 12 acids) in the fractions of sterol esters, mono- and diglycerides.

TABLE 2. PERCENTAGE FATTY ACID COMPOSITION IN THE TRIGLYCERIDE FRACTION

| Fatty acid | Per cent | Fatty acid | Per cent |
|---|---|---|---|
| 12:0 | 0·1 ± 0·01 | 18:2 | 14·7 ± 0·47 |
| 13:0 | tr | 18:3 a | 36·3 ± 0·92 |
| 14:0 | 0·8 ± 0·01 | 20:0 c | 2·0 ± 0·13 |
| 15:0 | 0·3 ± 0·02 | 20:2 | 0·9 ± 0·11 |
| 16:0 | 10·6 ± 0·22 | 20:3 | 0·5 ± 0·07 |
| 16:1 | 0·4 ± 0·03 | 20:4 | 4·4 ± 0·13 |
| 16:2 | 0·1 ± 0·01 | 20:5 b | 3·3 ± 0·14 |
| 17:0 | 0·1 ± 0·00 | 22:0 | 0·2 ± 0·04 |
| 18:0 | 1·1 ± 0·03 | 22:2 | 0·2 ± 0·06 |
| 18:1 | 23·9 ± 0·68 | 23:0 | tr |

a. May contain a small amount of 20:1
b. Contains a small amount of 24:0.
c. Contains 18:3 $\omega$ 6.

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