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LIPÍDIOS, PROTEÍNAS E AÇÚCARES EM ESPOROS DE *Cyathea delgadii* STERNB., *Polypodium latipes* LANGS & FISCH E *Trichipteris corcovadensis* (RADDI) COPEL.

LIPIDS, PROTEINS AND SUGARS IN SPORES OF *Cyathea delgadii* STERNB., *Polypodium latipes* LANGS. & FISCH AND *Trichipteris corcovadensis* (Raddi) Copel.

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RESUMO

(Lipídios, proteínas e açúcares em esporos de *Cyathea delgadii*, *Polypoidum latipes* e *Trichipteris corcovadensis*).

Cyathea delgadii e *Trichipteris corcovadensis* ocorrem nas matas úmidas da Serra do Mar, os esporos tendo sido coletados na Reserva Biológica do Parque Estadual das Fontes do Ipiranga, São Paulo. *Polypodium latipes* ocorre em cerrado e os esporos foram coletados em Moji-Guaçu. Neste trabalho foi determinado o conteúdo em lipídios livres, proteínas solúveis e carboidratos solúveis totais em esporos dessas três espécies. Nas três espécies, os lipídios são responsáveis por cerca de 50% do peso dos esporos. A germinação é alta e rápida em *C. delgadii* e *P. latipes* e muito baixa em *T. corcovadensis* nas amostras usadas neste trabalho. Os níveis de proteína e carboidratos são muito semelhantes para as duas espécies de mata. Em relação às espécies de mata estudadas aqui, esporos de *P. latipes* coletados em cerrado apresentaram níveis muito mais elevados de proteínas e carboidratos.

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PALAVRAS-CHAVE: *C. delgadii; P. latipes. T. corcovadensis;* lipídios; açúcares; proteínas; germinação.

ABSTRACT

(Lipids, proteins and sugars in spores of *Cyathea delgadii, Polypodium latipes* and *Trichepteris corcovadensis).*

Cyathea delgadii and *Trichipteris corcovadensis* occur in the wet forest of Serra do Mar. The spores of these two species were collected in the Reserva Biológica do Parque Estadual das Fontes do Ipiranga, São Paulo. *Polypodium latipes* occurs in "cerrado", the savannah-like type of vegetation of Brazil, and the spores were collected in Moji-Guaçu, S.P.. The content of free lipids, soluble proteins and total soluble sugars was determined in spores of these three species. Lipids are responsible for about 50% of the weight of the spores in the three species. Germination was fast and high in *C. delgadii* and *P. latipes* and very low in *T. corcovadensis* in the samples used in this work. The contents in protein and sugars were similar for the two species from the wet forest. Spores of *P. latipes* collected in the cerrado presented much higher levels of sugars and protein than spores from *C. delgadii* and *T. corcovadensis.*

KEY WORDS: *C. delgadii; P. latipes; T. corcovadensis;* lipids, sugars; proteins; germination.

INTRODUCTION

Changes in the biochemical composition of fern spores during germination have been shown for several species in recent years. Minamikawa et al (1984), for example, showed that in *Adiantum capillus-veneris* lipids are the main storage material and their content decreases during the germination process. Sugars are also important as carbon and energy sources during imbibition and germination. They also showed the presence of two storage proteins. Demaggio & Greenes (1980) showed that during germination of *Onoclea sensibilis* spores the amount of lipids decreased.

Cyathea delgadii and *Trichipteris corcovadensis* are tree ferns. *T. corcovadensis* occurs in the Serra do Mar area of

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Cyathea delgadii and *Trichipteris corcovadensis* are tree ferns. *T. corcovadensis* occurs in the Serra do Mar área of

Southern Brazil (Tryon, 1985); at elevations from 250 to 2100 meters (Barrington, 1978). *C. delgadii* grows in a great variety of ecological conditions; it occurs in Brazil mainly in the Serra do Mar area (Tryon, 1986). Thus, these species occur in the humid forests of Southern Brazil. *Polypodium latipes* is a hemicriptophyte and is one of the most frequent ferns found in the dry "cerrado". The spores of these three ferns only germinate in light (Marcondes-Ferreira & Felippe, 1984; Esteves & Felippe, 1985; Esteves et al., 1985) the majority of fern species present light-sensitive spores (Miller, 1968).

In this paper the amounts of lipids, soluble proteins and total soluble sugars in the spores of *C. delgadii*, *P. latipes* and *T. corcovadensis* were determined.

MATERIAL AND METHODS

Spores of *Cyathea delgadii* Sternb and *Trichipteris corcovadensis* (Raddi) Copel, were collected in the humid forest of Reserva Biologica do Parque Estadual das Fontes do Ipiranga, São Paulo, Brazil. *Polypodium latipes* Langs. & Fish. was collected in a dry area, the Reserva Biologica de Moji-Guaçu, S.P., Brazil. The spores were always stored in closed bottles in the dark at 4ºC.

Full details of the germination proceedings are presented in (Esteves et al. (1985). Temperature was maintained at 25ºC. Continuous fluorescent white light with irradiance of 224 uW. cm^{-2} was used throughout.

Lipids (total lipids soluble in hexane) were determined according to Gemmrich (1977), soluble protein according to Bradford (1976) and total soluble sugars according to Mc-Cready et al. (1950). In each extraction were used 100 mg of spores. Each material was analysed in triplicate. Lipids content was determined on days 0,7 and 14 of incubation for *C. delgadii* and *P. latipes* and on days 0,4,7,11 and 14 for *T. corcovadensis*. The values were subjected to analysis of variance (Snedecor, 1962).

RESULTS AND DISCUSSION

Table 1 shows the amounts of lipids, soluble protein and total soluble sugars in *C. delgadii*, *P. latipes* and *T. corcovadensis*. In all three species studied nearly half of the weight of the spores are lipids. The amount of protein is 5 times higher in *P. latipes* in relation to the other two species. The amount of total sugars is also much higher in *P. latipes*.

Lipids seem to be responsible for about 50% of the spore weight in several species, e.g. *Anemia phyllitides* (Gemmrich, 1977) *Pteris vittata* (Gemmrich, 1980) *Adiantum capillus - veneris* (Minamikawa et al. 1984), *Dryopteris filix-mas* (De Maggio & Greene, 1980). This, however is not a general rule, as spores of *Onoclea sensibilis* and *Matteuccia struthiopteris* present only 27% of the weight as lipid (DeMaggio & Stetler, 1988). The content of protein in spores of *P. latipes* is in the range found for *Onoclea sensibilis*, *Matteuccia struthiopteris* and *Dryopteris filix-mas* (DeMaggio & Stetler, 1988). It is possible that protein and carbohydrates are used as reserve material in *P. latipes* and are metabolized during germination. In *C. delgadii* and *T. corcovadensis* the content of protein and sugars is only 1% of spore weight. In *Onoclea sensibilis* with the photoinduction, sucrose (the reserve material in this case) is used up (Towill, 1985). There is a reduction in soluble sugars during the germination of *Adiantum capillus-veneris* (Minamikawa et al., 1984). If the difference in protein and carbohydrate contents between the species collected in the "cerrado", *P. latipes*, and the two collected in the humid forest (*C. delgadii* and *T. corcovadensis*) is of ecological significance it is too early to discuss. More research is still needed.

The germination values and the amount of lipids during 14 days of incubation are shown in figure 1. Germination values are very similar for *P. latipes* and *C. delgadii*. Germination was very low for *T. corcovadensis*. The germination data for these three species have been discussed previously (Esteves & Felippe, 1985; Esteves et al., 1985; Randi & Felippe, 1988). The amount of lipids was very similar

throughout the experiment for *T. corcovadensis*. There was no differences, according to the F test, for days 0,4,7,11 and 14 of the incubation period. There was a sharp fall between days 0 and 7 in the case of *C. delgadii* (maximum germination by day 7); the content also decreased in *P. latipes* (in this case maximum germination day 6), but not like *C. delgadii*. About 50% of the lipids content of spores of *Pteris vittata* are metabolized by day 10 of the incubation period (Gemmrich, 1980) and the same was found for *Adiantum capillus-veneris* (Minamikawa et al., 1984). In the case of *C. delgadii* lipids seem to be the main spore reserve (see figure 1). In the case of *P. latipes* the content of lipids also decreased but nothing comparable to *C. delgadii*. However, in the three species, lipids metabolism seems to be involved in spore germination. In the case of *T. corcovadensis* the germination is very low and there is no drop in lipids content.

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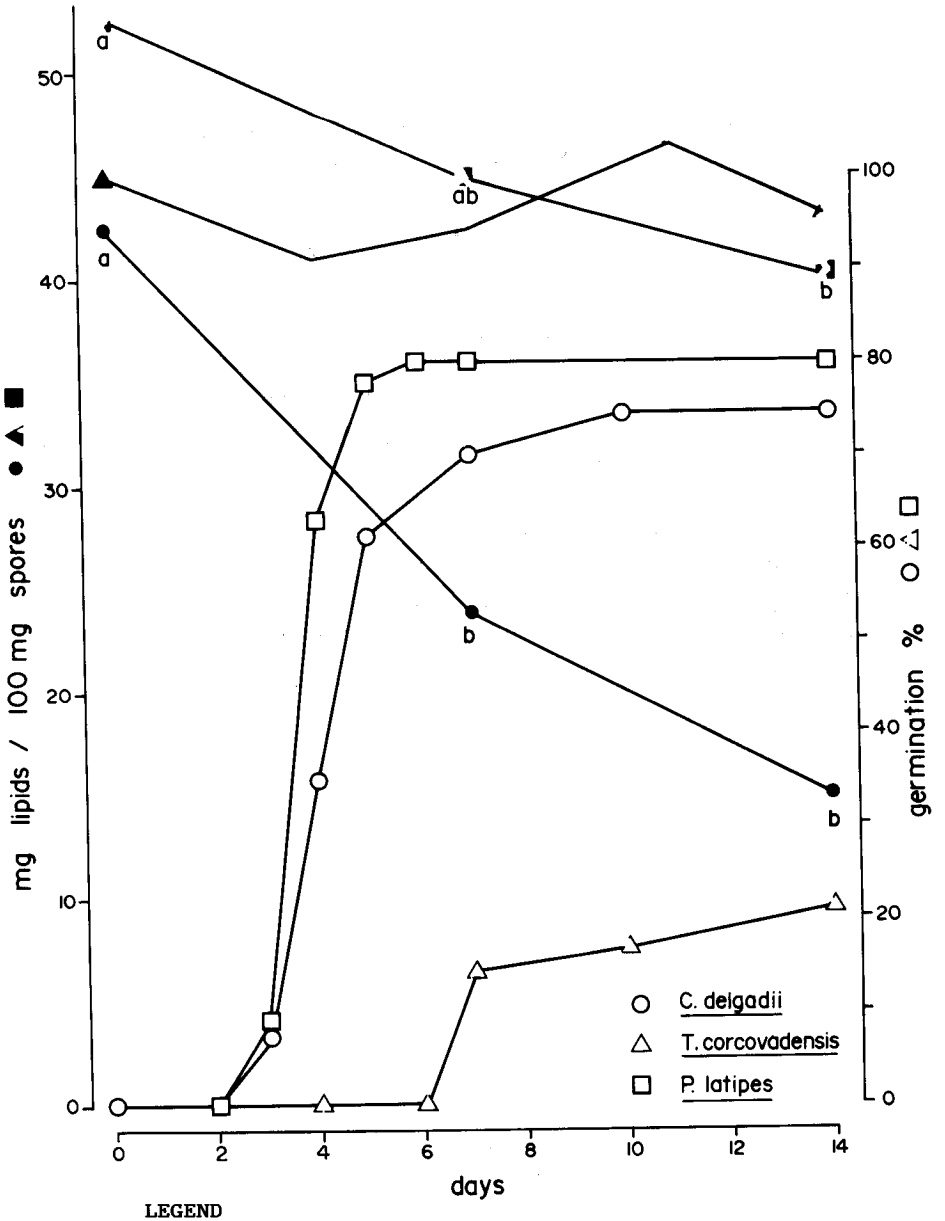

FIGURA 1. Germination and lipids content in *Cyathea delgadii*, *Polypodium latipes* and *Trichipteris corcovadensis*. Germination: open symbols; lipids content: closed symbols. *C. delgadii*: circles; *P. latipes*: squares; *T. corcovadensis*: triangles.

TABLE 1

Lipids, soluble proteins and total soluble sugars in spores of *C. delgadii*, *P. latipes* and *T. corcovadensis* (x ± standard error).

	µm/mg spores		
	lipids	soluble protein	soluble sugars
C. delgadii	425.0 ± 12.0	12.0 ± 0.46	18.4 ± 0.31
P. latipes	520.0 ± 25.0	60.9 ± 4.45	62.9 ± 2.16
T. corcovadensis	450.0 ± 18.3	11.4 ± 0.41	14.8 ± 0.28