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Systematic Studies on the Conducting Tissue of the Gametophyte in Musci

(14) Anatomy of the Stems of *Rhizogonium*, *Mnium* and *Fissidens*

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Abstract Experiments on the absorption of pigments by the gametophytes of *Rhizogonium*, *Mnium* and *Fissidens* in which each tissue within the stems was stained with different dyes, led to the conclusion that the stems of *Rhizogonium*, *Mnium* and *Fissidens* appear to be differentiated into an epidermis, cortex, leptome and hydrome.

In future studies, it is hoped that the relationships existing among gametophytes of Musci will be investigated according to the color adopted by each tissue, those showing similar dyeing properties being considerd to be homologous tissues.

Introduction

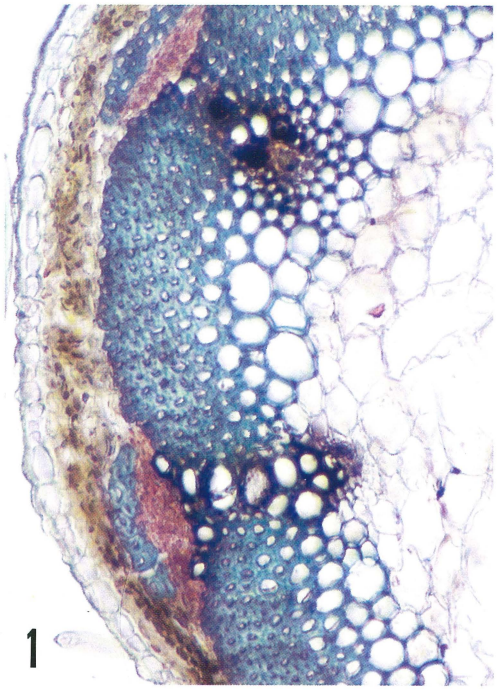
Previous investigations on the absorption of pigments by the gametophytes of *Polytrichum*, in which each tissue within the stem was stained with different dyes, led to the following results. (1) The cell walls of the epidermis were dyed red with eosin solution. (2) The cell walls of the cortex were dyed blue-green with methyl green solution. (3) The cytoplasm of the leptome was dyed red with eosin solution. (4) The cell walls of the hydrome were dyed violet-brown with a respective of solutions of aniline blue and eosin, Janus green and eosin, and Congo red and gentian violet.

Using the Congo red-gentian violet-eosin-methyl green-method it was shown that in *Lepidium virginicum* L. the cytolasm of phloem was dyed red with eosin, and that the cell walls of xylem vessels were dyed violet-brown with the solution of Congo red and gentian violet (Figs. 1 and 2).

In conformity with these results, the inner structures of the stems of certain members of the Musci were investigated, and the findings are reported here.

Materials and Methods

The materials used in this study were samples of the mosses *Rhizogonium*, *Mnium* and *Fissidens*. Observations were conducted after subjecting the mosses to the following staining procedures.



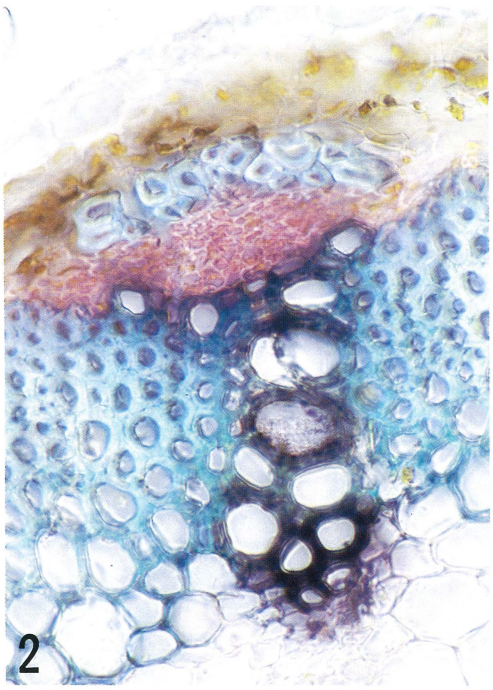


Fig. 1 (x 60) and Fig. 2 (x 200) : Cross sections of the stem of *Lepidim Viriginicum* L. The cell walls of the xylem vessels were dyed violet with the solution of Congo red and gentian violet. The cytoplasm of the phloem were dyed red with eosin solution.

(1) *Rhizogonium*

a) A solution of aniline blue and eosin was absorbed into the gametophyte for seventy -two hours.

b) After washing, a solution of eosin was absorbed into the gametophyte for seventy -two hours.

c) After further washing, a solution of methyl green was absorbed into the gametophyte, again for seventy-two hours. After washing, cross-sections of the moss about 15μm in thickness were cut with a cryo-microtome and mounted in gum arabic.

(2) *Mnium*

a) A solution of aniline blue and eosin was absorbed into the gametophyte for seventy -two hours.

b) After washing, a solution of eosin was absorbed into the gametophyte for seventy -two hours.

c) After further washing, a solution of methyl green was absorbed into the gametophyte, again for seventy-two hours. After washing, cross-sections of the moss about 15μm in thickness were cut with a cryo-microtome and mounted in gum arabic.

(3) *Fissidens*

a) A solution of Janus green and eosin was absorbed into the gametophyte for thirty-six hours.
b) After washing, a solution of eosin was absorbed for a further thirty-six hours.
c) After further washing, a solution of methyl green was absorbed into the moss, again for thirty-six hours. After washing cross-sections of the moss about 15μm in thickness were cut with a cryo-microtome and mounted in gum arabic.

Results and Discussion

In the vascular plant *Lepidium*, the cell walls of the xylem vessels were dyed violet with the Congo red and gentian violet, and the cytoplasm of the phloem was dyed red with eosin.

In *Polytrichum* of the Musci, the cell walls of the hydrome were dyed violet with the combination of Congo red and gentian violet, anilin blue and eosin, and Janus green and eosin, and the chloroplasts of the cortex and the cytoplasm of the leptome were dyed red with eosin. (Plate I)

From these results, it may be considered that the xylem vessels of *Lepidium* are homologous to the hydrome of *Polytrichum*, and that the phloem of *Lepidium* is homologous to the leptome of *Polytrichum*.

In *Rhizogonium*, the cell walls of the epidermis were dyed red with eosin, and the cell walls of the cortex were dyed blue-green with methyl green. The chloroplasts of the cortex and the cytoplasm of the several layers inside the cortex were dyed red with eosin. These results suggest that in *Rhizogonium*, the several layers inside the cortex may be homologous to the leptome of *Polytrichum*. Similarly, the central part of the stem in *Rhizogonium* may be homologous to the hydrome of *Polytrichum*, because the cell walls of the latter were dyed violet-blue with the solution of aniline blue and eosin. (Plate I)

In *Mnium*, the cell walls of the epidermis were dyed red with eosin, and the cell walls of the cortex were dyed blue-green with methyl green. The chloroplasts of the cortex and the cytoplasm of several layers inside the cortex were dyed red with eosin. These results suggest that in *Mnium*, the several layers inside the cortex may be homologous to the leptome of *Polytrichum*. Similarly, the central part of the stem in *Mnium* may be homologous to the hydrome of *Polytrichum*, because the cell walls of the latter were dyed violet-blue with the solution of aniline blue and eosin. (Plate II)

In *Fissidens*, the cell walls of the epidermis were dyed red with eosin, and the cell walls of the cortex were dyed blue-green with methyl green. The chloroplasts of the cortex and the cytoplasm of several layers inside the cortex were dyed red with eosin. These results suggest that in *Fissidens*, the several layers inside the cortex may be considered to be homologous to the leptome of *Polytrichum*. Similarly, the central part of the stem in *Fissidens* may be homologous to the hydrome of *Polytrichum*, because the cell walls of the central part of the stem were dyed violet-blue with the solution of aniline blue and eosin. (Plate II)

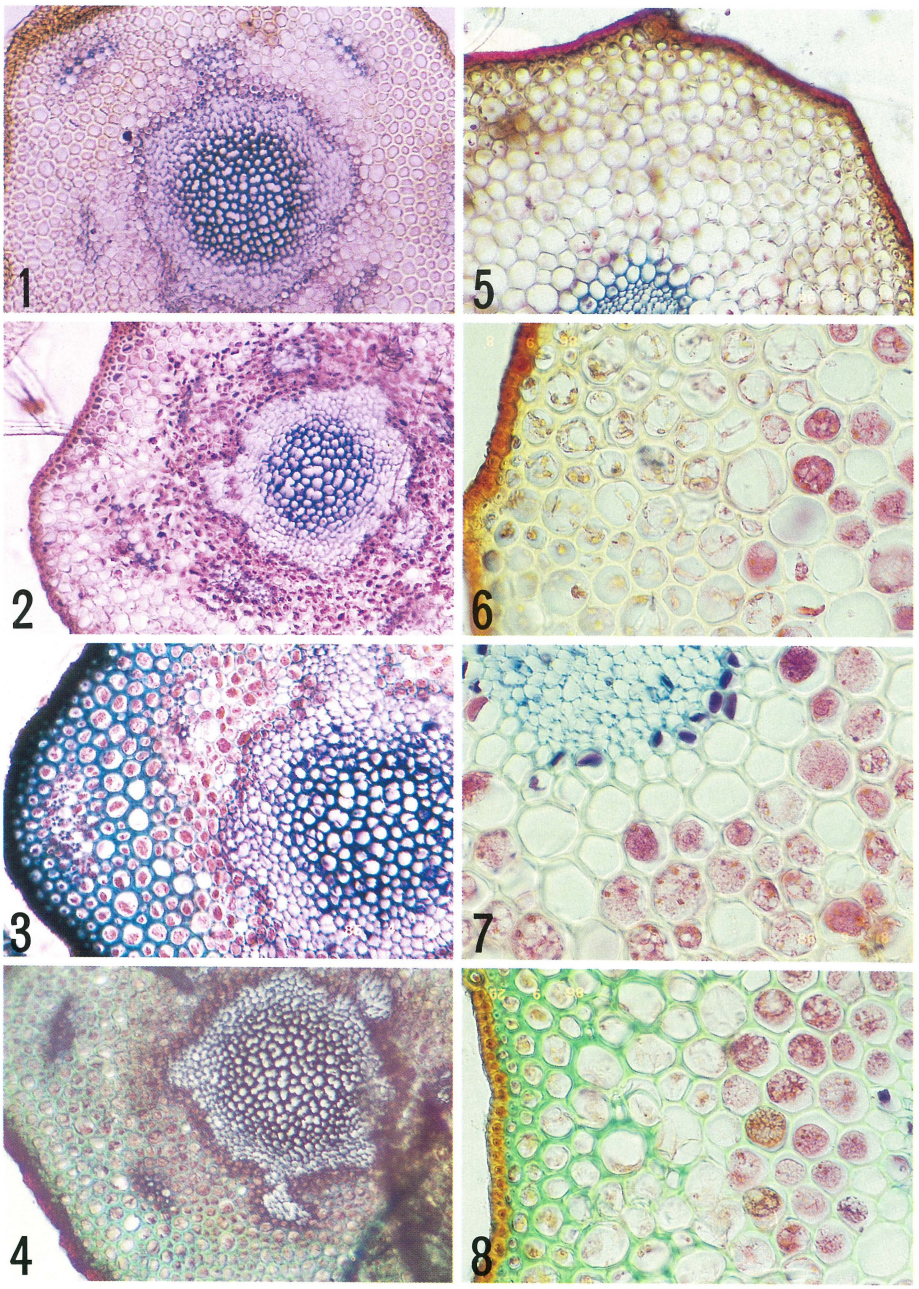


Plate I. Cross sections of the stem
Fig. 1-Fig. 4 : *Polytrichum*, Fig. 5-Fig. 8 : *Rhizogonium*.
Fig. 1 : The cell walls of the hydrome were dyed violet-blue with the solution of aniline blue and eosin. Fig. 2 : The cytoplasm of the leptome were dyed red with the eosin solution. Fig. 3 : The cell walls of the cortex were dyed blue with the methyl green solution. Fig. 4 : The cell walls of the epidermis were dyed red with the eosin solution and the cell walls of the cortex were dyed blue -green with the methyl green solution (distilled water). Fig. 5 : The cell walls of the hydrome were dyed blue with the solution of aniline blue and eosin. Figs. 6, 7 : The cytoplasm of the leptome were dyed red with the eosin solution. Fig. 8 : The cell walls of the cortex were dyed green with the methyl green solution.

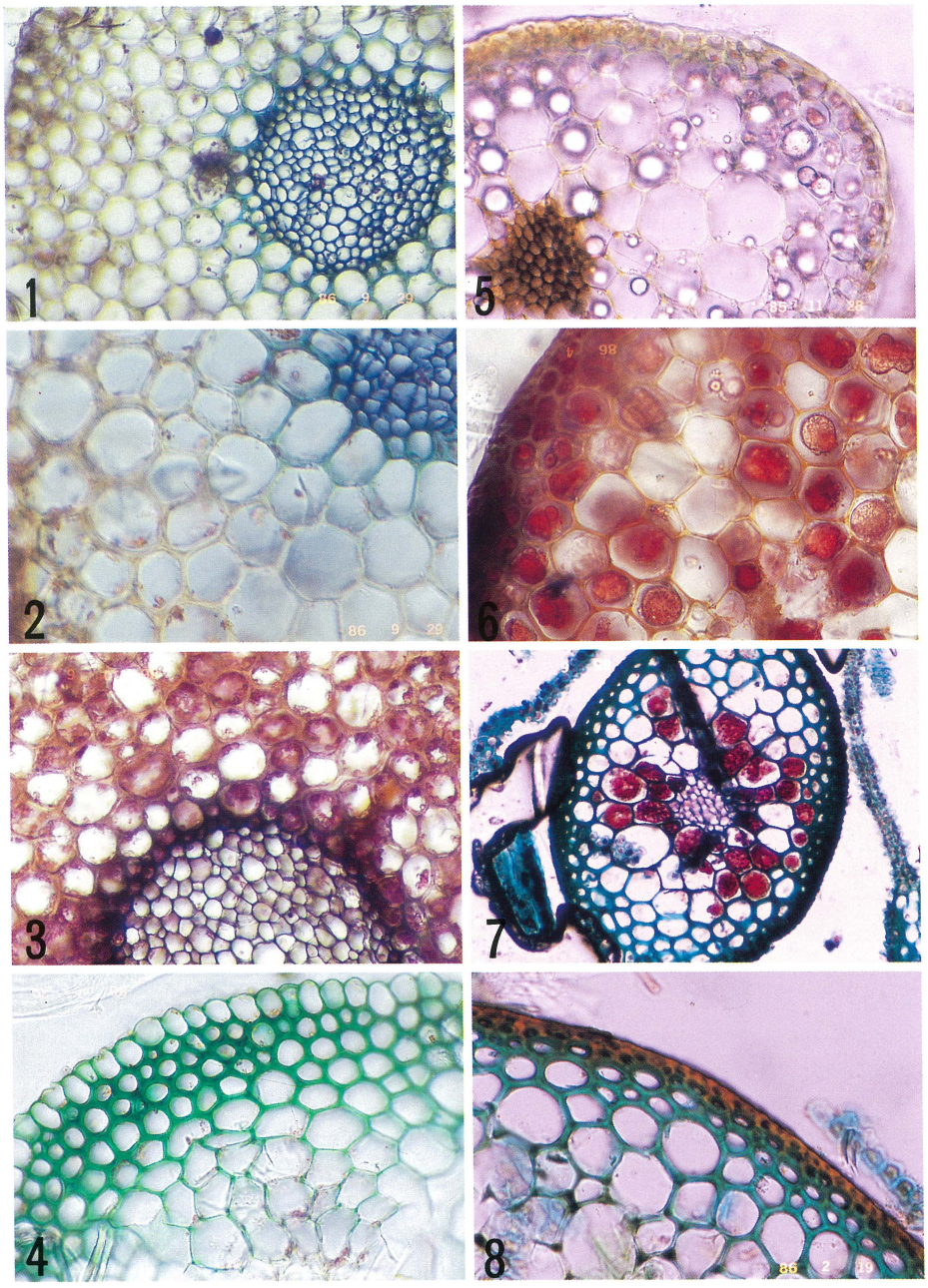


Plate II. Cross sections of the stem

Fig. 1-Fig. 4 : *Mnium*, Fig. 5-Fig. 8 : *Fissidens*

Figs. 1, 2 : The cell walls of the hydrome were dyed violet-blue with the solution of aniline blue and eosin. Fig. 3 : The cytoplasm of the leptome were dyed red with the eosin solution. Fig. 4 : The cell walls of the cortex were dyed blue with the methyl green solution. Fig. 5 : The cell walls of the hydrome were dyed violet-brown with the solution of aniline blue and eosin. Fig. 6 : The cytoplasm of the leptome were dyed red with the eosin solution. Fig. 7 : The cell walls of the cortex were dyed blue with the methyl green solution. Fig. 8 : The cell walls the epidermis were dyed red with the eosin solution, and the cell walls of the cortex were dyed blue with the methyl green solution (distilled water).

From these experimental results, it appears that the stems of *Rhizogonium*, *Mnium* and *Fissidens* are differentiated into an epidermis, cortex, leptome and hydrome.

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