

INDUCED ABERRANT GAMETOPHYTES FROM *HAPLOMITRIUM ROTUNDIFOLIUM*

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Distinct aberrant gametophytes have developed from the spores of *Haplomitrium rotundifolium*. At first, spores were sown in distilled water, and then transferred to 50% Hoagland's solution. Gradually, the spores became swollen, green and floating on the surface of the solution. Cell division soon took place and a triangular structure (Yang 1966) resulted at the end of 6 months. One year later, leafy gametophytes were completed in culture (Yang 1967). Since then, they have been maintaining vigorous growth and green color for almost three years by constant transfers to new media. The rate of their growth is very slow and the size of these aberrants are small and have borne no reproductive organs.

A comparison of aberrant plants with those collected from the field in September and December 1968 reveals the following characters:

1. **Height of aberrants**—The average height of the aberrants is about 16 mm, but the highest plant reached 22 mm, while those collected from the field only attained an average of 12 mm although their highest was 25 mm; those collected Dec. 14, 1968 are very short, their average was about 5 mm, or only one third or one fourth of that of the aberrants.

The stem of the aberrants is much longer than those of the ordinary plants. Its elongation is due to the abnormal extension of the internodes (Plate I, Figs. 2-5) which cause the whorls of leaves to be widely separated on the stem. In the normal plants their internodes are very short so the ranks of the leaves are closely arranged in almost a rosette fashion.

2. **Rhizome-like branches**—After the arising of rhizome-like short branches usually from the nodes of the stem, especially toward its lower part, initiations of young leafy branches took place. Meristematic cells, therefore, originate in an axillary position as well as apical region (Pl. IV, Figs. 5, 6). They induce accelerated growth and resumption of axillary branching so that multi-headed plants (Pl. I, Figs. 1-2, 4) are commonly met with.

The rhizome-like branches in normal plants also arise from the base of the stem but they are often embedded in the substratum and not spreading in the air as those of the aberrants.

3. **Leaves**—The leaves are spirally arranged in three ranks on the stem, they are differentiated into two ranks of larger leaves and one rank of smaller ones— which are equivalent to the underleaves in other leafy liverworts. This differ-

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entiation of three ranks of leaves is clearly shown in the aberrants (Pl. I, Fig. 3; Pl. II, Figs. 1-2). In normal plants, the three ranks of leaves are almost of the same size, closely arranged on the stem. The diameter of an aberrant leaf is about 1 mm, while that of the leaves of normal plants is 1.5-2 mm.

4. **Leaf cells**—In the leaf cells the oil bodies are of two types, the spherical and the spindle. The latter is much more numerous than the former. Some of the elongated oil bodies look like 3 or 4 beads joined together to make a linear body. As they grow older, they may separate and become a number of spherical bodies. (Pl. III, Figs. 1-2)

In the leaf cells of a normal plant and or in the older leaves, the oil bodies are nearly all spherical. Under the microscope, they are bright, shining specks, and the conspicuous elongated ones are rarely seen.

5. **Mucilaginous papillae**—These are often observed in aberrant leaves, similar to those on the normal plants, except that in the former they are distributed along the leaf margins more often than in other parts of the leaf. Plate II, Figs. 1-2 show some of the leaf margins bearing them. Plate II, Fig. 3 shows 2 papillae on the apical leaf margin and Fig. 4 several papillae covered with a mucilaginous substance.
6. Cytological study of the leaf cells of the aberrants reveals a number of them are undergoing cell division. The material studied was taken from the young apex of the aberrant and also from the rhizomatous branch-tip. Most of the cells were at prophase when they were fixed at 12:15 a.m. The other stages such as anaphase and telophase were also observed (Pl. III, Figs. 5-6). The formation of a cell plate was seen in Fig. 6.

CONCLUSION

1. The aberrant gametophytes induced from the spores of *Haplomitrium rotundifolium* were grown on 50% Hoagland solution medium solidified by 1% agar and 0.25% activated charcoal. These are definitely small in size, although their height surpasses that of the normal plants grown in the field. On the average, they are about 3 or 4 times taller than those of the normal plants, but their width is about 1 mm while that of the latter 1.5-2 mm.
2. Nodal meristematic cells give rise to axillary branching which leads to the formation of multiheaded plants.
3. Oil bodies in leaf cells of aberrants are usually of the linear or spindle-shaped type while those in normal plants are nearly all spherical-shaped.
4. The cytological study of aberrant cells has not been conducted on enough material to draw definite conclusion or to compare them with normal plants. The chromosome number found in this study is 8 instead of 9 as previously reported in normal plants. This needs further study.

5. Induced aberrants although growing successfully in culture, increase in number of individuals continuously but they never show any indication of developing sex organs.
6. Repeated transfers have maintained vigorous growth and constant morphological characteristics of the aberrants of *H. rotundifolium* for more than three years already, in a controlled laboratory.

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EXPLANATION OF FIGURES

Plate I

- Fig. 1. Aberrants from an antiseptic culture, top view $\times 1.5$
Fig. 2. Ditto, side view showing elongation of branches. $\times 1.5$
Figs. 3-4. Showing 7 plants in the foreground, with 3 ranks of leaves $\times 8$
Fig. 5. One single plant showing elongated internodes and apical primordia $\times 20$
Fig. 6. Habit, female plants taken from field $\times 1.5$

Plate II

- Figs. 1-2. Showing apical view of two ranks of larger leaves and one rank of smaller ones $\times 20$
Fig. 3. Papillae on apical leaf margin $\times 150$
Fig. 4. Ditto with mucilaginous substance $\times 150$
Fig. 5. Showing new aberrants arising from rhizome-like stem (\surd). $\times 1.5$

Plate III

- Figs. 1-2. Spindle or linear shaped oil bodies from leaves of aberrant gametophyte $\times 600$
(Phase contrast)
Figs. 3-4. Spherical oil bodies from leaves of fresh specimen collected from field $\times 600$
Fig. 5. Cells taken from tip of rhizomatous branch showing prophase $\times 600$
Fig. 6. Ditto, showing telophase and cell plate $\times 600$

Plate IV

- Fig. 1. Cross section of stem, apical portion $\times 28$
Fig. 2. Ditto, basal portion showing central mass and cortex separated by a ring of thick walled cells. $\times 28$
Fig. 3-4. Apical meristem from 2 different plants. $\times 100$
Fig. 5. Longitudinal section of stem showing meristematic cells in the apex and elongating cells below. $\times 100$
Fig. 6. Ditto, showing cells of branching initiations (\surd) $\times 28$

Plate I

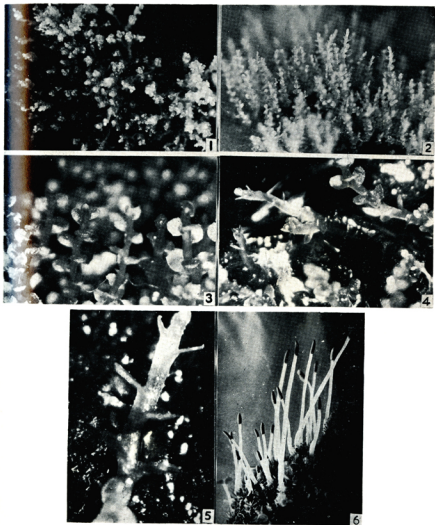


Plate II

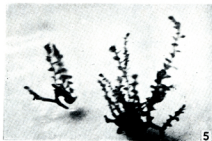
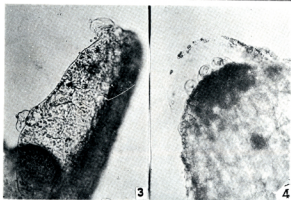
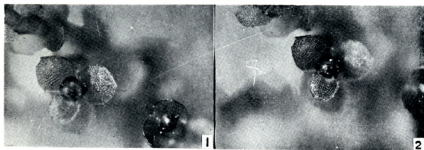


Plate III

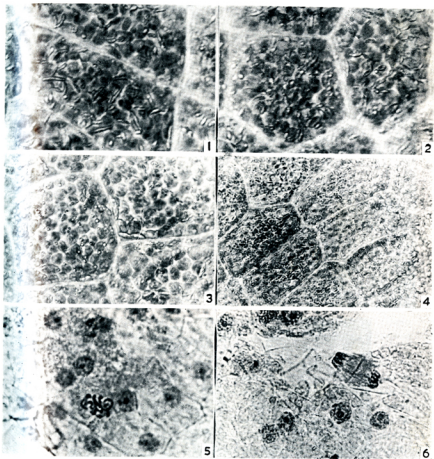


Plate IV

