

*The Genetics of Sex in Funaria hygrometrica.*

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For dioecious mosses El. and Em. Marchal\* have shown that sex segregation occurs at the meiotic division of sporogenesis, inasmuch as the individual spores which initiate the haploid gametophytic phase are uni-sexual, producing protonemata from which are developed leafy axes all of one sex either male or female.

In a former paper† the writer has shown that vegetative cultures derived from the antheridia and the surrounding "perigonial" leaves of the male "inflorescence" of *Funaria hygrometrica*—a monœcious type of moss—produced male plants only, whilst cultures derived from spores reproduced the normal monœcious plants.

From this evidence it appeared probable that at some point in the cell divisions by which the axis and its organs are developed, a separation takes place such that the element upon which the monœcious condition depends is dropped out of those cells from which the male organ with its surrounding leaves is formed.

It was therefore highly desirable that vegetative cultures should be made from the female sexual organ and the leaves surrounding it, their genetic potentialities being unknown. These experiments have now been carried out, vegetative cultures having been raised both from the archegonium and from the surrounding "perichæatial" leaves of *Funaria hygrometrica*.

After the fertilisation of the egg, the flask-shaped archegonium enlarges considerably, the basal part (or venter) particularly becoming much inflated. In this condition it is quite easy to remove the greater part of the archegonium (the venter with the surmounting neck) for the purpose of experiment.

Cultures were made from the inflated venter and neck shortly after its appearance above the surrounding perichæatial leaves and also from these leaves.

Four pot cultures in all were established on sterilised soil, two from the venter and two from perichæatial leaves. All were placed under a cloche upon moist sand in a zinc tray, together with a fifth pot of soil sterilised in the same way, but upon which no culture had been sown. The pots were watered with boiled distilled water through an opening in the top of the cloche. No growth appeared in the control pot.

These cultures have produced typical monœcious plants.

\* 'Mém. de l'Acad. Roy. de Belgique,' 1906; 'Bull. de l'Acad. Roy. de Belgique Classe des Sciences,' 1907, 1909, 1911.

† 'Journal of Genetics,' vol. 8, 1919.

It appears evident, therefore, that up to the point of the formation of the female organ, the cells of the haploid gametophytic phase retain the power to produce monœcious plants, whereas the leaves surrounding the male organ have lost this power.

In *Funaria* in the early condition the shoot bearing the male inflorescence overtops the axis bearing the archegonia, and this appearance leads to the assumption that the female shoot is a lateral development. From specimens taken from my cultures (see text-figure) the point of origin of the female



Tracings from photographs of four *Funaria* plants, showing relation of female shoot to male. In each case the female is distinguished by the protruding "neck."

shoot appears variable, and in some cases the structure simulates a dichotomy. More rapid growth of the male axis for the very obvious purpose of facilitating fertilisation would lead to the axis bearing the archegonia assuming a lateral position. In view of the new observations as to the difference in potentialities of the male and female shoots, it becomes important to determine the morphological relation of the two parts and their exact cell-lineage. For at some critical cell division a change takes place: either the power to produce the monœcious plants is extruded in the female shoot, the deficient male axis continuing the development; or a bud which has lost this power is extruded as the male shoot, while the female shoot retains it and continues the development of the axis.

In this connection it is interesting to observe that Miss E. R. Saunders has shown me some of her preparations of the termination of the female axis, which show the presence of antheridia among the archegonia.

The cytological aspect of the phenomena has not been studied, and the generally accepted alternation of generation within the group with its  $n$  and  $2n$  phases has been assumed throughout.