THE BEARING OF CYTOLOGICAL STUDIES ON THE PHYLOGENY OF THE MARCHANTIALES

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Introduction

One of the chief aims of the "Natural System" of classification of plants, first propounded by Antoine Laurent de Jussieu in 1789 and adopted subsequently by all the botanists, is to arrange various groups of plants in an order indicative of their relationship or affinities. In building up our phylogenetic schemes in such a system we have to use all the possible data collected from various sources and view them in a proper perspective. Up to the end of the last century such data were forthcoming mainly from the morphological studies; but since the beginning of the present century the science of cytology has opened up a new line of enquiry the findings of which have helped much to clear up some tangles in the mass of morphological evidence at our disposal. The greater part of this evidence pertains to the Angiosperms and that is but natural. The lower plants, however, have not been neglected and the pertinent data gathered in this field though not so vast as in the case of Angiosperms are likely to prove useful in our phylogenetic speculations. It is proposed to review here briefly the evidence obtained from the cytological studies on the liverworts and to indicate its bearing on the phylogeny of the Marchantiales.

The researches on the cytology of the Marchantiales go as far back as Koch (1890–91) and Schottländer (1892) but the most important advances in our knowledge of the cytology of this group are of recent origin. They are mainly due to the work of Allen (1917, 1924, 1925, 1926, 1937), Showalter (1921, 1923, 1928), Haupt (1932, 1933), Heitz (1927, 1928), Lorbeer (1927, 1930, 1934), Höfer (1932), Siler (1934), Wolcott (1939) and others. It is to these authors that we owe much of our knowledge of the chromosomes in the principal genera of the liverworts, though of course, many genera still remain unworked. About 235 genera comprise this group and our cytological knowledge extends to about 50 of them. Apparently we have gained but little insight in the cytology of this group. Similar investigations on the cytology of the Indian forms have been made by workers like
Kashyap and Pande (1922), Pande (1924, 1932, 1933, 1934, 1936), Mehra (1938), Mehra and Mehra (1939), Chavan (1937 b), Srinivasan (1939, 1940), Mahabalé and Gorji (1941), but looking to the richness of the liverwort flora in this country a large portion of this field remains to be covered. About 525 species of Indian liverworts have been described by Stephani (1898–1925) to which Kashyap (1929, 1932) and Chopra (1932) added about 50 more; some more forms have been added by Gola (1914), Khanna (1929, 1932, 1936, 1937), Verdoorn (1931, 1932 a), Chavan (1937 a) and others, while our knowledge of their cytology does not extend beyond a dozen forms. Fragmentary as our knowledge is regarding the cytology of the liverworts an attempt is made here to apply it, more in the way of offering some comments on the existing phylogenetic speculations, than for making any original observations.

The Data and Their Analysis

For the sake of convenience the data available have been grouped under the following four headings:—

1. Data pertaining to sex chromosomes,
2. Data pertaining to hybridization,
3. Data pertaining to polyploidy and gene-mutations,
4. Data pertaining to the morphology and number of chromosomes in different genera and species.

1. The sex chromosomes in the Hepaticae.—The first discovery of the sex chromosomes in plants was made by Allen (1917) in 1917 in Sphaerocarpus Domellii and led the way to similar investigation in other dioecious species of liverworts. They have been reported to be present in genera like Pellia, Riccia, Pallavicinta, Riccardia, Lunularia, Tesselina, Makinoa, etc. in all about 22 species. But there is some confusion yet regarding their occurrence in species like Riccardia pinguis and Riccia Courtsii due to faulty nomenclature as has been pointed out by Allen (1935, p. 275). The mechanism so far discovered is of the XY-type differing in detail only in genera like Lunularia and Frullania. Heteropycnosis was observed in some of them, e.g., in Pellia Neesiana by Showalter or in Hookeria lucens by Heitz but not in all. We have not yet been able to observe the occurrence of sex chromosomes in many other genera of the liverworts. There is not much difficulty about the dioecious species. The real difficulty is about the hermaphrodite ones. The issue before us is to know how these hermaphrodite forms have come into existence. Have they descended from the diploid races of the originally haploid dioecious parents as Heitz and Allen (1932,