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STUDIES ON M-CHROMOSOME IN LIVERWORTS FROM WEST HIMALAYAN REGION

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Abstract:

Cytological studies were made in two liverworts collected from Lal tibba, Mussoorie and Glen, Shimla belonging to Western Himalayan region. The chromosome number was reported to be n=9 in both the liverworts i.e. *Conocephalum conicum* and *Plagiochasma articulatum*. The presence of an m- chromosome (8+m) has been reported in both the plants, which is in accordance with the earlier reports. This dissociation is probably due to small size of the chromosomes permitting few or no chiasmata. It is nearly one-tenth or less the size of the largest chromosome.

1.0 Introduction:

Of the nearly 9000 liverworts spp. (Crandall-Stotler and Stotler 2000), so far only 697 spp. representing 156 genera are known cytologically (Anand et al. 1989, Kumar and Anand 1990, Fritsch 1991, Kumar and Kapila 2003). In India, so far 850 spp. of liverworts belonging to 140 genera and 52 families are reported (Norkett, cf. Chopra 1975). Despite the rich diversity of Bryophytes in the Indian subcontinent, cytological study of this group has not received deserved attention. Studies focussed on cytology of Indian liverworts were pioneered by Mehra (1948, 1959, 1977), Srinivasan (1940, 1944), Mahable and Gorji (1941), Chopra and Udar (1957), Udar and Chopra (1957), Mehra and Pathania (1959), Kanwal(1974, 1975, 1976a, 1976b), Mehra and Kumar(1979, 1980). Later Anand et al. (1989), Kumar and Anand (1990) and Kumar and Kapila (2003) made significant contribution to the cytology of West Himalayan liverworts.

The m- chromosome is a regular member of the chromosome complement. The m- chromosomes have been studied exclusively either in meiosis or mitosis but unfortunately m-chromosomes at these stages have not been compared with each other. In meiosis, the term m- chromosome has been used for chromosomes which separate prematurely. This dissociation is probably due to small size of the chromosomes permitting few or no chiasmata. As a rule, there is only one such chromosome in mosses with the haploid level of chromosome no. This m- chromosome is as a rule the smallest chromosome in the normal chromosome complement.

The present study is undertaken to gain cytological information about the plant samples of ***Conocephalum conicum***(On the way to Glen Shimla) and ***Plagiochasma articulatum***(On way to LalTibba- Mussoorie) from West Himalayan areas to observe how far this data could be useful in phylogeny and cytological evolution of Bryophytes.

2.0 Materials and Methods:

The materials for the present study were collected from Glen Shimla and Lal Tibba Mussoorie during the months of October 2008 and February 2009 respectively.To study meiotic chromosomes, young capsules of green colour with brown annulus were fixed in 1:3 acetic alcohol for 24 hrs. After this, they were stored in 90% alcohol. To examine the dividing spore mother cells, slides were prepared. The capsule was slightly punctured with the help of a fine needle in a drop of 2% acetocarmine. After tapping the capsule with the help of a glass rod, debris was removed with the help of a pointed needle. Then coverslip was placed on the slide and it was heated repeatedly at 50-60°C for

a few seconds. Slide was then pressed in the folds of blotting paper to squeeze out extra stain. To make the slides permanent, the coverslips were separated by placing them in 1:3 acetic alcohol in a petridish. Then the coverslip and the slide were passed separately through 1:3 acetic alcohol, 1:6 acetic alcohol, 1:9 acetic alcohol and absolute alcohol grades and were finally mounted separately in a drop of Euparal.

3.0 Observations and Results:

3.1 Conocephalum Conicum (L.) Dum.- n=9 (8+m) (fig.1)

The presently studied material was collected from Shimla (on the way to Glen, alt. 1830m) and inhabited densely shaded wet rocks. The species was dioecious and was characterised by conical female receptacle borne terminally on the thallus. The largest thalli was upto 10 cm. long and had distinct polygonal areas and pores which were visible to the naked eye.

The present report, n=8+m is in accordance with some earlier reports(Showalter, 1921a, 1921b; Tatuno, 1938a, 1941a, 1941b; Newton, 1973a). Some investigators (Meyer, 1929; Lorbeer, 1934- as *Fagatella conica* Corda; Tatuno, 1948, 1957; Oosaki, 1980) did not report the presence of m-chromosome in the nine chromosome complement . The other investigated species of the genus *C. Supradecompositum* (Lindb.)(Steph.) also show n=9(Lorbeer, 1934;Tatuno 1938c, 1941a, 1941b, 1948, 1957), which may be regarded as the base number of this genus and the monotypic family Conocephalaceae.

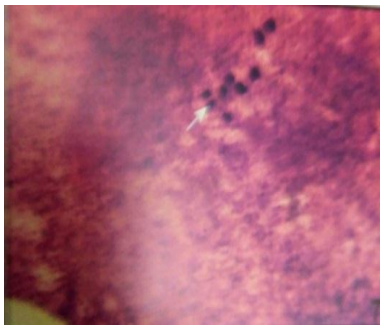

Fig:1-Metaphase-I Showing 8 Bivalents & an m-chromosome (Arrow Marked)

3.2 Plagiochasma Articulatum Kash.- n=9(8+m)(fig. 2)

The presently studied material was found growing on soil in Mussoorie (on the way to Lal Tibba, alt. 2200m.) The plants were monoecious and were characterised by articulated thalli and the female receptacles borne at the articulations. At metaphase-I, the chromosome number n=9 is observed which agrees with the earlier findings in Japanese(as *P. nipponicum*Horik.- Tatuno, 1939a, 1941a, 1941b, 1956a) and Indian (Mehra, 1977; as *P. pterospermum* Mass.- Bischler, 1979a) polulations of this species. Bivalents showed a tendency to lie together. The smallest, lightly stained member of the set, as earlier reported by Mehra (1977), was designated as m- chromosome and it showed premature dissociation.

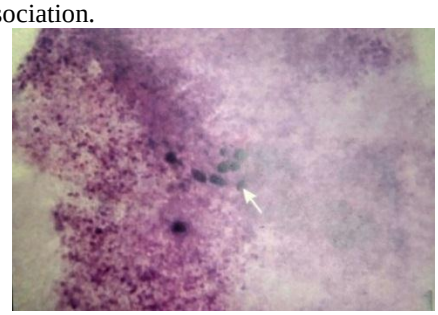

Fig.2: Metaphase-I, Showing 8 bivalents & disjoined m-bivalent (Arrow Marked)

4.0 Discussion:

Heitz (1927a) and Lorbeer (1934) used the term m-chromosome for the smallest member of the chromosome complement of the liverworts. Tatuno (1941b) coined the term h-chromosome for this chromosome and correlated its association with sex- determination in certain liverworts. In mosses, this term was first applied by Heitz (1942) to the faintly stained, presumably heterochromatic, smallest member of the set and later adopted by subsequent investigators. Tatuno and Yano(1953) and Yano (1957b, 1957c, 1957d) however designated it as h-chromosome.
The precocious disjunction of m-bivalent is attributed to its's small size, short pairing segment, early chiasmata terminalisation (Smith, 1978) and even lack of pairing and absence of chiasmata (Anderson, 1964). It is nearly one-tenth or less the size of the largest chromosome.

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