

facilities in various ways during the progress of this investigation.

MADHUSUDAN CHAKRABARTY.

Botanical Laboratory,
Calcutta University,
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¹ Bose, S. R., *Polyporaceae of Bengal*, 9; *Jr. Dept. Sc. C. U.*, 9, p. 36.

CHROMOSOMES OF *RICCIA* *HIMALAYENSIS* St. (Ms.)

STUDY of the differentiation of sex in plants and animals has always fascinated biologists to look for deeper causes underlying this great morphological fact; and, one of the most widely accepted explanations of this phenomenon is the sex-chromosome mechanism. Towards the beginning of the present century the sex-chromosome was discovered in animals, particularly in the Insecta, by workers like McClung¹ (1902), Wilson² (1904) and others; but not till 1917 was it found in plants, when Allen³ (1917) first discovered it in a Bryophyte, *Sphaerocarpus donnellii*. Subsequent researches showed that it occurs in plants belonging to other groups also, e.g., in *Rumex*, *Humulus*, *Cannabis*, etc. Many bryophytic genera were also investigated with a hope of finding it in them, and it was found in some of them too, e.g., in *Pallavicinia*; but with the growing mass of information about the cytology of liverworts, it became evident that a heteromorphic chromosome as one finds in *Sphaerocarpus* is not of universal occurrence in them. For example Showalter⁴ (1921) did not find it at all in *Conocephalus*; whereas the reports regarding its occurrence in species of *Riccia* like *R. Curtisii*⁵ or *R. Bischoffi* were conflicting.

A careful consideration of the various Indian liverworts described by the late Prof. Kashyap⁶ (1915, 1916, 1929, 1932) does suggest a possibility of finding a sex-chromosome in some of them at least; but unfortunately our knowledge of the cytology of these forms, except perhaps that of the Codoniaceæ worked out by Mehra⁷

(1938), is very meagre. Even the commonest genera like *Riccia* or *Marchantia* have not been worked out thoroughly. An investigation, therefore, of some of the species of *Riccia* found in this part of the country was undertaken and the results obtained in one of them, namely, *Riccia himalayensis*,⁸ are given below.



FIG. 1

Riccia himalayensis St. (Ms.). $\frac{2}{3}$ Natural size

The material for the present investigation was collected in the vicinity of Ahmedabad and Poona and fixed in Allen-Bouin, Flemming's strong fluid, Navaschin's and other fixatives. It was cut by the usual paraffin or Dioxane method and stained with Heidenhain's Hæmatoxylin. Many clear equatorial plates were obtained in the cells of young developing antheridia and some in the meristematic cells on the dorsal surface near the growing point of the thallus, but not in the cells undergoing sporogenesis. This is largely due to the fact that the spore-mother-cells undergoing tetrad divisions are full of oil globules and granular cytoplasm which render the achromatic spindle obscure; and this has been the experience of many other workers also.⁹

Fig. 1 is a photograph of the plants the chromosomes of which have been determined and are shown in Fig. 2. Fig. 2 a and b show them in antherids and Fig. 2 c shows them in a meristematic cell of the thallus cut slightly obliquely. It is evident that there are eight chromosomes in the haploid nucleus of the species. Seven of them are slender, elongated, not straight, but bent in crooked forms and

consequently irregular in outline. The eighth element is much smaller than the rest and is often elusive on account of its small size and



FIG. 2.

Riccia himalayensis St. (Ms.). Chromosomes: (a) and (b) Polar views of equatorial plates in antherids; (c) in a meristematic cell of the thallus. $\times 1200$.

dot-like form. This is perhaps the reason why authors like Beer¹⁰ (1906) have said that the reduced number of chromosomes in *Riccia glauca* is either seven or eight. In our preparations also we did get plates showing only seven chromosomes but in other clear metaphase plates the occurrence of the eighth element was unmistakable. The attachment of the seven large chromosomes is atelomitic and that of the small eighth element telomitic. There is no heterochromosome in this species; and the diploid number of chromosomes seems to be 16. It is interesting to note that this very number is found in two other species studied by Lorbeer¹¹ (1934) and Siler¹² (1934), namely in *Riccia fluitans* and *Riccia donnellii*, whereas the great majority of the species like *Riccia crystallina*, *Riccia sorocarpa*, *Riccia arvensis* have only 8 chromosomes in the diploid condition. Evidently *Riccia himalayensis* is a diploid species as contrasted with species like *Riccia crystallina* which have the basic eight number. This is perfectly in accordance with Heitz's¹³ (1927) observation that 'the liverworts with 8 or 9 chromosomes are predominantly dioeci-

ous, whereas those with 16 or 18 or other multiples of the basic number are predominantly hermaphroditic'.

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T. S. MAHABALE.
G. H. GORJI.

Biology Department,
Gujarat College,
Ahmedabad,
December 14, 1940.

¹ McClung, C. E., *Biol. Bull.*, 1902, **3**, 43.

² Wilson, E. B., *Science*, 1905, **20**, 564.

³ Allen, C. E., *Ibid.*, 1917, **46**, 466.

⁴ Showalter, A. M., *Bot. Gaz.*, 1921, **72**, 245-49.

⁵ McAllister, F., *Bull. Torrey Bot. Club.*, 1928, **55**.

⁶ Kashyap, S. R., *New Phytol.*, 1914, **13**, 206, 226; *Ibid.*, 1915, **14**, 1 and 308; *Journ. Bom. Nat. Hist. Soc.*, 1917, **24**, 343; "Liverworts of the Western Himalayas and the Punjab Plain," Part I, 1929 and Part II in collaboration with R. S. Chopra, 1932.

⁷ Mehra, P. N., *Proc. Ind. Acad. Sci.*, 1938, **8**, 1.

⁸ This species is perhaps synonymous with *Riccia discolor* L. et L. (*Vide* Kashyap, *New Phytol.*, 1915, **14**, 18; see also *Journ. Bom. Nat. Hist. Soc.*, 1917, **24**, 349. A somewhat similar opinion about this species has been expressed by Dr. S. K. Pande of the University of Lucknow, in a letter to the senior author (T. S. M.) dated 29th October 1940.

⁹ See Campbell, D. H., *Mosses and Ferns* (3rd Ed.), 1918, p. 34; see also Pande, S. K., *Journ. Ind. Bot. Soc.*, 1933, **12**, 117.

¹⁰ Beer, R., *Ann. Bot.*, 1906, **20**, 288.

¹¹ Lorbeer, G., *Jahrb. wiss. Bot.*, 1934, **80**, 565.

¹² Siler, M. B., *Proc. Nat. Acad. Sci.*, 1934, **20**, 603.

¹³ Heitz, E., *Abhandl. Naturwiss. ver. Hamburg*, 1927, **21**, 48.

SOIL ALGÆ OF LAHORE

FOR sometime past effort has been made to study the Algal flora of some of the representative soils from Lahore with particular attention to record, if possible, some of the new forms not already reported to be occurring in the soil. Accordingly three types of surface soils, namely,