

KARYOTYPE OF SOME SPECIES OF *CHARA* AND *NITELLA* (CHAROPHYTA) FROM BANGLADESH

WAHIDA KHATUN, MD. MOSLEH UD-DEEN* AND GOLAM KABIR

Professor Sultanul Alam Cytogenetics Laboratory, Department of Botany,
University of Rajshahi, Rajshahi-6205, Bangladesh.

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Abstract

Karyotypic analysis of *Chara corallina* Linn., *C. vulgaris* Linn., *C. gymnopitys* Linn. and *Nitella translucens* Ag. collected from natural habitats revealed that *C. corallina* has $n=42$, *C. vulgaris* and *Chara gymnopitys* have $n=14$ while *Nitella translucens* has $n=18$ chromosomes. All the species had differences in individual chromosome length, total chromatin length, total frequency between the complements of their chromosomes. The proposed standard karyotype formula were $6L^m + 2M^m + 26M^{sm} + 6S_1^m + 2S_2^m$ for *Chara corallina*, $4M^m + 8S_1^m + 2S_2^m$ for *Chara vulgaris*, $6M^m + 4S_1^m + 2S_2^{sm} + 2S_2^m$ for *Chara gymnopitys* and $6L^m + 2L^{sm} + 6M^m + 2M^{sm} + 2S_1^m$ for *Nitella translucens*.

Cytological investigation on the chromosome number in members of charophyta from India have been made in the last several decades (Noor 1969, Noor and Mukherjee 1977, Khan and Sarma 1967, Sinha and Verma 1970).

It has been reported that the chromosomes of algae are predominately like that of the higher plants and most of the green algae possess localized centromeres as do most of the higher plants (Nagl and Furening 1979). In the present study, an attempt has been made to report the chromosome number and their morphology because so far no such work has been done in Bangladesh.

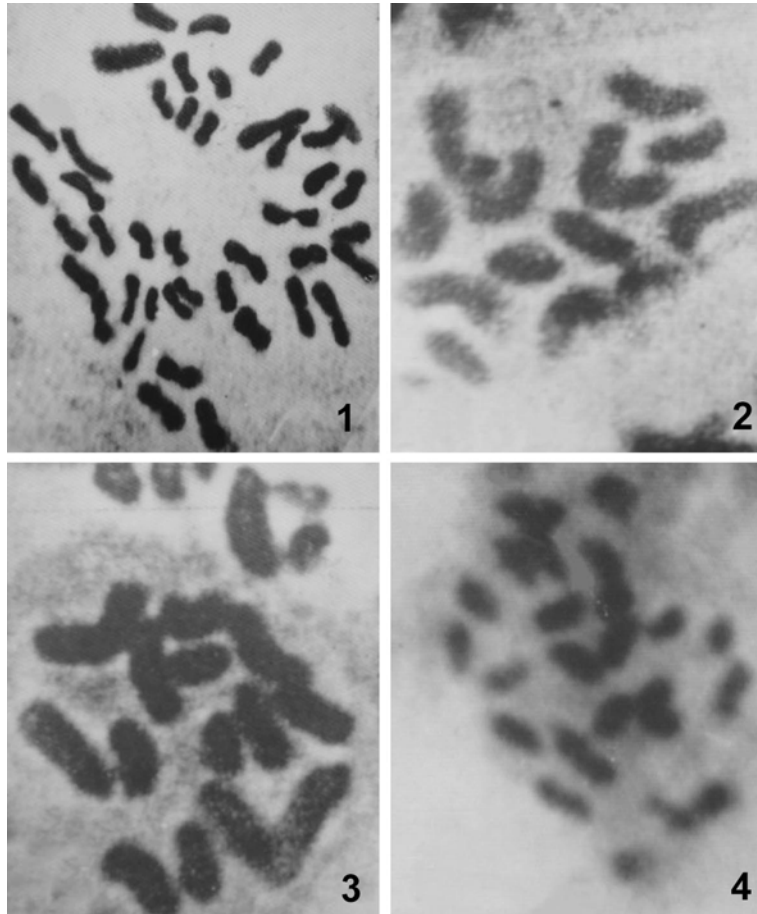
Chara corallina Linn., *Chara vulgaris* Linn., *Chara gymnopitys* Linn. and *Nitella translucens* Ag. were collected from different places in Rajshahi district, Bangladesh. These species were identified based on monographs by Paul *et al.* (1960) and the British Charophyta by Groves and Webster (1920). Antheridial filaments were the most favourable material for cytological study. Green tips with prominent sex organs were collected and fixed in 1:1 aceto-alcohol solution for 24-48 hours and then transferred to 70% ethanol. During cytological investigation Godward's (1948) iron-alum acetocarmine method was applied with slight modification. Sometimes for clear staining 1% haematoxylin was used instead of acetocarmine. Squashing and light tapping were carried out for better spreading of metaphase chromosomes in one plane. The number of chromosomes for each of algal species were counted and length of chromosomes with respect to the centromeric position were measured from camera lucida drawings. From the total chromatin length (TCL), TF% and coefficient of variation (CV) among the chromosome complement were computed statistically by conventional methods to characterize each of four karyotypes of the Charophytes.

The haploid chromosome numbers were found to be 42, 14, 14 and 18 in *Chara corallina*, *C. vulgaris*, *C. gymnopites* and *Nitella translucens*, respectively (Figs 1-4, Table 1). Khan and Sarma (1967), Noor (1969), Hotchkiss (1963) and Sinha and Noor (1971) also observed same chromosome numbers for the above taxa.

¹Corresponding author: Department of Crop Science and Technology, University of Rajshahi, Rajshahi-6205, Bangladesh. E-mail: muddeen05@yahoo.com

In *Chara corallina* the chromosomes were, 6 long metacentric, 2 medium metacentric, 26 medium sub-metacentric, 6 short metacentric and 2 relative short metacentric. The length of the chromosomes ranged from 1.99 to 4.77 μm with a TCL of 148.68 μm . TF% was 45.85 and the karyotype formula was $6L^m + 2M^m + 26M^{sm} + 6S_1^m + 2S_2^m$.

In *Chara vulgaris* the 14 chromosomes were of metacentric type. The largest one was 3.43 μm and the shortest was 1.67 μm . TCL was found to be 36.64 μm and TF% was 46.28 with the karyotype formula $4M^m + 8S_1^m + 2S_2^m$.



Figs 1-4. Chromosome morphology in four species of green algae (ca 750 \times). 1. *Chara corallina*, 2. *Chara vulgaris*, 3. *Chara gymnopitys* and 4. *Nitella translucens*.

In *Chara gymnopitys* the chromosomes were mostly of metacentric type, only 2 were sub-metacentric. The length of chromosomes ranged between 1.85 and 3.43 μm with a TCL of 38.67 μm and TF% was 45.46. The karyotype formula was determined as $6M^m + 4S_1^m + 2S_2^m + 2S_2^{sm}$.

In *Nitella translucens* out of 18 chromosomes 6 were long metacentric, 2 long sub-metacentric, 6 medium metacentric, 2 medium sub-metacentric and 2 short metacentric. The chromosome length ranged between 2.91 and 6.45 μm with a TCL of 81.69 μm and TF% was 46.11. The karyotype formula was determined to be $6L^m + 2L^{sm} + 6M^m + 2M^{sm} + 2S_1^m$.

Table 1. Total chromatin length (TCL), total frequency and karyotype formula of four green algal species.

Organisms	Chromosome Number (n/2n)	Chromosome Length (µm)	TCL	Karyotype formula				Total Frequency	Co-efficient of variation
				L	M	S ₁	S ₂		
<i>Chara corallina</i> L.	42	1.99-4.77	148.68	6L ^m	2M ^m + 26M sm	6S ₁ ^m	2S ₂ ^m	46.42	19.49
<i>C. vulgaris</i> L.	14	1.67-3.43	36.64	-	4M ^m	8S ₁ ^m	2S ₂ ^m	45.84	20.47
<i>C. gymnopitys</i> L.	14	1.84-3.43	38.67	-	6M ^m	4S ₁ ^m	2S ₂ sm +2S ₂ ^m	45.46	21.66
<i>Nitella translucens</i> Ag.	18	2.91-6.45	81.69	6L ^m + 2L sm	6M ^m + 2M sm	2S ₁ ^m	-	46.11	23.89

Chromosome number studied in the four species confirmed the previous reports. Many workers reported 7 as the basic chromosome number for the genus *Chara* and 6 for the genus *Nitella* (Khan and Sarma 1967, Sinha and Verma 1970, Sarma and Ramjee 1971, Noor and Mukharjee 1977, Chatterjee 1979). The present findings also confirms above reports but many a times more than 7 in *Chara* spp. and more than 6 in *Nitella* sp. were observed. After a brief review on the basic chromosome number on the *Chara* and *Nitella* taxa, it appeared that polyploidy have played an important role in the mechanism of speciation in this group.

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References

- Chatterjee P. 1979. Karyological investigation of *Chara wallichii* A. Br. Cell Chromosome Newsletter **2**(1): 21-23.
- Godward M.B.E. 1948. The iron alum acetocarmine method for algae. Nature **16**: 203.
- Groves J and G.R.B. Webster. 1920. The British Charophyta. Vol. 1: 110-113. Nitalue, London.
- Hotchkiss A.T. 1963. A first report of chromosome number in the genus *Lychnothamnus* (Rupr.) Leonh. and comparison with other Charophyte genera. Proc. Linn. Soc. N.S.W. **138**: 368-372.
- Khan M. and Y.S.R.K. Sarma. 1967. Some observations on the cytology of indian Charophyta. Phytos **6**: 62-74.
- Nagl W. and H.P. Furening. 1979. Types of chromatin organization in plant nuclei. Plant Syst. Evol. Suppl. **2**: 221-233.
- Noor M.N. 1969. A preliminary report on the chromosome number in some indian Characeae. J. Ranchi Univ. **6-7**: 242-239.
- Noor M.N. and S. Mukherjee. 1977. Some new records of chromosome number in indian Charophyta. Cytologia **42**: 227-232.
- Paul B.P., B.C. Kundu, V.S. Smuderalugus and G.S. Venkataramn. 1960. Monograph Charophyta. ICAR Pub., New Delhi. 130 pp.
- Sarma Y.S. and M. Ramjee. 1971. Significance of chromosome numbers in Charophyta- A discussion. Caryologia **24**: 391-401.
- Sinha J.P. and B.N. Verma. 1970. Cytological analysis of the Charophytes of Bihar. Phytos. **9**: 92-99.
- Sinha J.P. and M.N. Noor. 1971. Studies on the karyology of some members of Charophyta of Bihar. Phytos. **10**: 112-117.

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