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Chromosome Count in *Macrocystis integrifolia* Bory

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Abstract

The reliable chromosome number of *Macrocystis integrifolia* Bory obtained at Sitka, Alaska, U.S.A. was estimated to be n=32, 2n=64; this number being derived by counting in the cells of female gametophytes and young sporophytes. In previous chromosome records for *Macrocystis*, this number was identical to *M. angustifolia*, and showed polyploidy to *M. integrifolia* obtained from British Columbia, Canada.

The chromosome number of the giant kelp, *Macrocystis integrifolia* Bory has been given by Walker (1952) and Cole (1968) using materials obtained in British Columbia, Canada. Our chromosome count for this alga from Sitka, Alaska indicated polyploidy as described below.

Material and method

The plant for this study was collected in May 1986 at Sitka, Alaska, U.S.A. An ice bag containing parts of the mature portions was sent by air to the Hokkaido Regional Fisheries Laboratory at Kushiro, Hokkaido Japan. Here, the zoospores were liberated in the sea water. In order to carry out a cytological study, the gametophytes in the two-month old culture in PES medium (Provasoli, 1966) were transported to the laboratory in the Faculty of Fisheries, Hokkaido University in Hakodate. In the laboratory, the gametophytes were first kept in Erd-Schreiber for two weeks, and then transferred into filtered seawater with 0.01% SLP (Squid Liver Protein Powder) extract which had the effect of accelerating the maturation of *Undaria* gametophytes (Yabu et al, 1984). After two weeks in the solution at 15° C, 4000 lux (12 hr light and dark photo-period), the majority of gametophytes of both sexes attained maturity when they were fixed in acetic alcohol (1 : 3). Staining was done with aceto-iron-haematoxylin-chloral hydrate solution (Wittmann, 1964).

Results

As shown in Table 1 and Figs. 1, 5-10 & 24, the chromosome number of *Macrocystis integrifolia* studied here was ca 40-60, 32, ca 32 or ca 16, however the reliable chromosome number is considered to be n=32, 2n=64, and it is supposed that the sporophytes having ca 40-60 chromosomes are normal sporophytes, the ones

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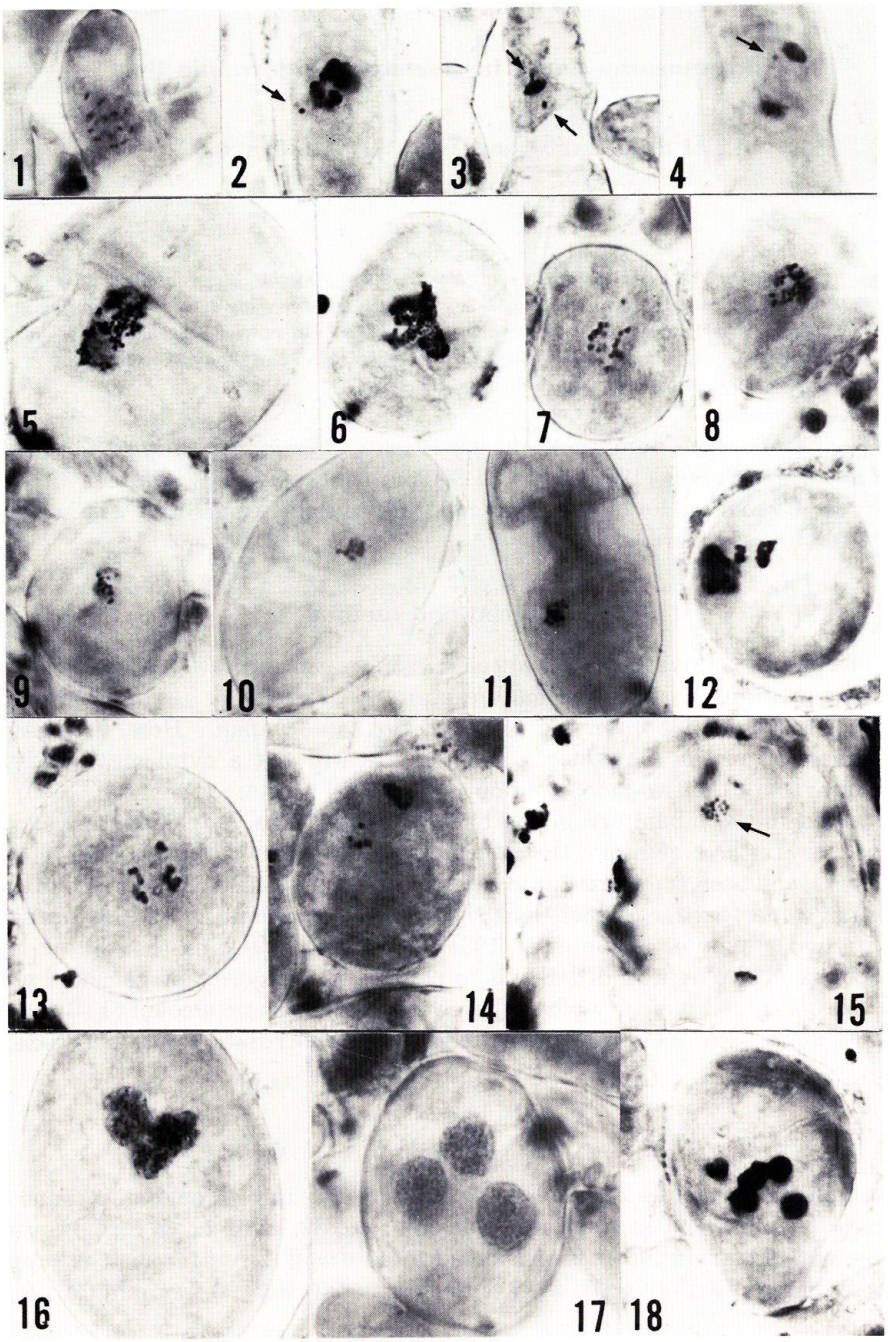
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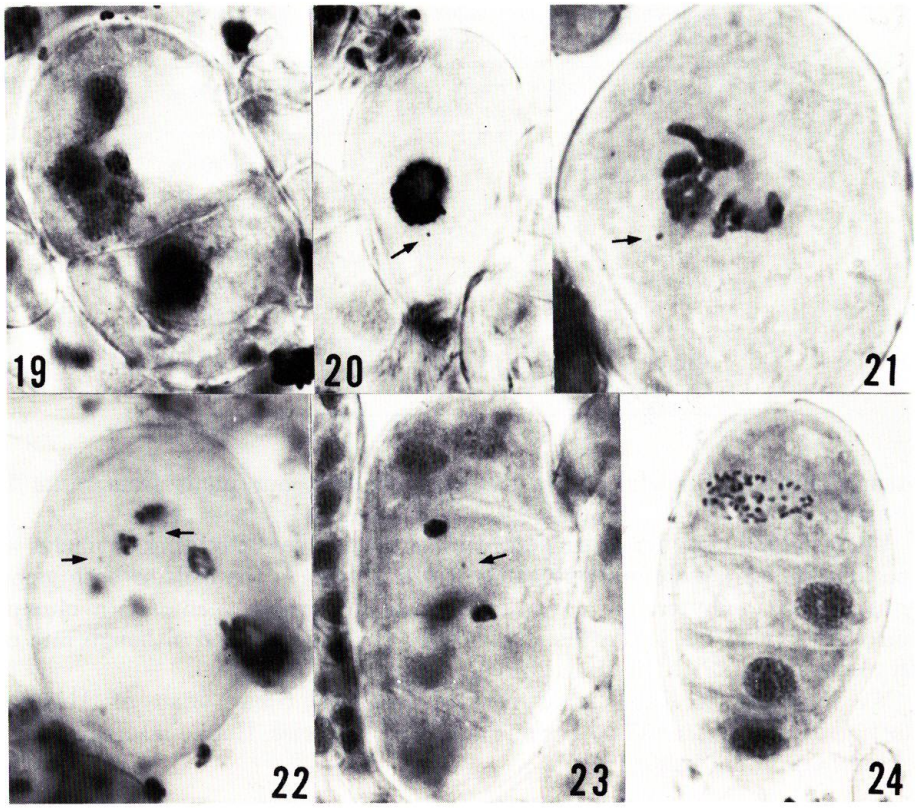

Figs. 1-24. *Macrocystis integrifolia* Bory. All ×970.

Figs. 1-4. Dividing nuclei in the vegetative cells of female gametophytes: 1. Late prophase. 2. Early anaphase with precocious chromosome (arrow). 3. Metephase with precocious chromosome (arrow). 4. Anaphase with lagging chromosome (arrow).

Figs. 5-24. Dividing nuclei in the cells of young sporophytes: 5-6. Metaphasee of diploid nucleus in one-celled sporophytes. 7-8. Metaphase of haploid nucleus in one-celled sporophytes. 9-11. Metaphase with ca 16 chromosomes in one-celled sporophytes. 12-14. Metaphase of diploid (Fig. 12) and haploid (Figs. 13-14) nucleus, having clumping chromosomes. 15. Metaphase of haploid nucleus (arrow) in the cell of young sporophyte. Only 16 chromosomes are seen in a focus. 16-18. One-celled sporophyte with multi-nuclei. 19. Two-celled sporophyte of which upper cell contains 8 nuclei. 20-21. Precocious chromosome (arrow) at metaphase of diploid nucleus in one-celled sporophyte. 22. One-celled sporophyte containing multi-nuclei, one of which is mataphase with precocious chromosome (arrow). 23. Lagging chromosome (arrow) at anaphase in the cell of six-celled sporophyte. 24. Metaphase of diploid nucleus in the cell of four-celled sporophyte.

having 32 or ca 32 chromosomes are parthenosporophytes, and the other ones having ca 16 chromosomes are also parthenosporophytes but are from the female gametophytes which arose due to irregular meiosis in the zoosporangium. These results are identical to those of *M. angustifolia* from California, U.S.A. (Yabu & Sanbonsuga, 1985). The chromosome number of *M. integrifolia* has been reported to be n=16, 2n=32 by Walker (1952) and n=14-16, 2n=28-32 by Cole (1968) in materials from

Table 1. Chromosome number examined for *Macrocystis integrifolia* Bory

Portion	Number of cells observed	Chromosome number
Cell of female gametophyte	18	ca 30
One-celled sporophyte	66	ca 40-60
	14	ca 30
	11	32
	6	ca 16
Cell of sporophyte	52	ca 40-60
	19	ca 30

British Columbia, Canada. Thus this suggests that our plant from Sitka is a polyploid.

We met such cytological irregularities as the frequent dividing of nuclei with precocious or lagging chromosome (Figs. 2-4 & 20-30) in the cells of both gametophytes and sporophytes, and occasionally the metaphase nuclei with clumping chromosomes (Figs. 12-14) in the single-celled sporophytes, and although rare cells with multi-nuclei (Figs. 16-19 & 22).

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