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Nuclear divisions in the tetrasporangia and tetraspore germlings of *Gelidium amansii* Lamouroux

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Some cytological aspects in the tetrasporangia and in the tetraspore germlings at an early developmental stage were reported for *Gelidium amansii* Lamouroux (Gelidiaceae, Rhodophyta) collected from Hakodate, Hokkaido. The nuclei at diakinesis and metaphase I in the tetrasporangia and at late prophase in the single-celled tetraspore germlings with empty spore membrane were revealed to have n=22–26 chromosomes, from which n=25 is supposed to be the reliable number due to the its frequent appearance.

Key Index Words: chromosome number—cytology—Gelidium amansii.

The cytological studies hitherto being published for the species in the Gelidiaceae (Gelidiales, Rhodophyta) were quite recently listed by Kapraun and Bailey (1989, p.203, Table 1) to show their chromosome numbers. The present communication gives some cytological data of *Gelidium amansii* Lamouroux collected at Tachimachi-misaki, Hakodate, Hokkaido.

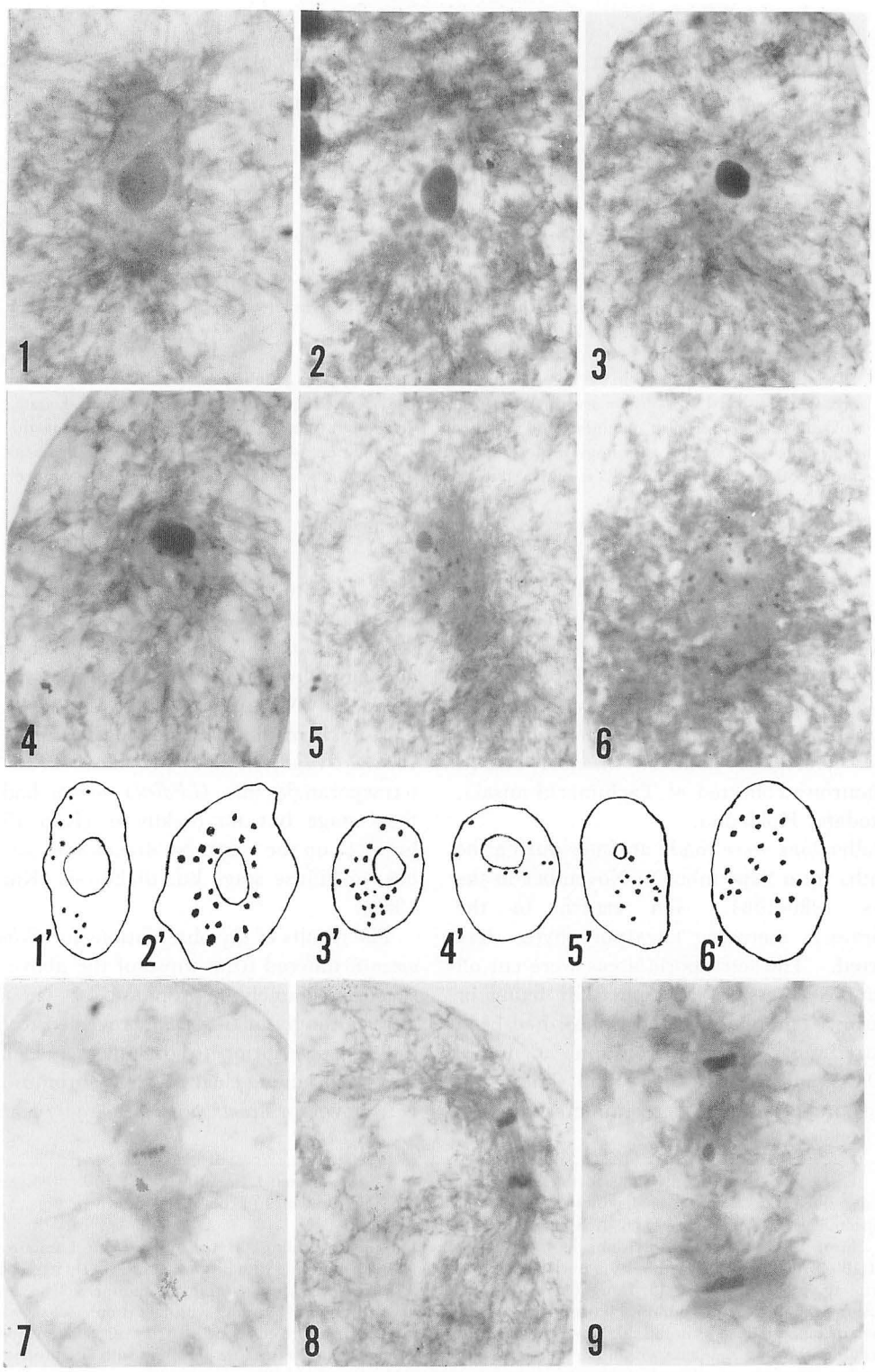
Collections were made at times during the months from September to November in the years 1980-1984. On return to the laboratory, maturing tetrasporophytes were selected. The tetrasporic areas were cut off from the plants to use either for fixing or culture. The liberated tetraspores had been cultured in Schreiber solution at 15°C, 2000 lux and 12 : 12 LD. The slides with tetraspore germlings were immersed in fixative at 2 to 3 days after spore liberation. Aceto-alcohol (1 : 3) was employed as fixative. Staining was done with aceto-iron-haematoxylin-chloral hydrate solution recommended by Wittmann (1965).

Meiosis in the tetrasporangia (Figs. 1-9): It was reported for prophase I in the tetrasporangia that *Gelidiella acerosa* had diffuse stage but no diakinesis (Rao 1974), however on the contrary, *Acanthopeltis japonica* has no diffuse stage but diakinesis (Kaneko 1968).

The results of my observations for *Gelidium amansii* differed from those of the above two species, namely, prophase I in the tetrasporangia of *G. amansii* revealed to have diffuse stage prior to diakinesis. Definite diakinesis having clear bivalent chromosomes was shown for *Acanthopeltis japonica* by Kaneko

Figs. 1–9. Nuclear divisions in the tetrasporangia of *Gelidium amansii* Lamouroux ×1,100. 1–5. Successive nuclear movements in diakinesis. 6. Metaphase I. 1′–6′. Drawings of the nuclei shown in Figs. 1–6, respectively. 7. Metaphase I. 8. Anaphase I. 9. Late anaphase I.

Figs. 10–17. Nuclear divisions in the tetraspores and their germlings of *Gelidium amansii* Lamouroux ×1,100. 10. Tetraspore with resting nucleus. 11. Early tetraspore germling with prophase. 12. Early tetraspore germling with metaphase. 13. Daughter nucleus (pointed by arrow) remaining within the spore envelope, after finishing the nuclear division in a tetraspore. 14. Single-celled tetraspore germling with late prophase, showing small metaphase nucleus in the side view (pointed by arrow) within the spore envelope. 15. Two-celled tetraspore germling, showing anaphase within the spore envelope. 16. Single-celled tetraspore germling with late prophase, showing numerous small nuclei within the spore envelope. 16′. Drawing of Fig. 16. 17. Two-celled tetraspore germling, showing many small nuclei which are vanishing within the spore envelope.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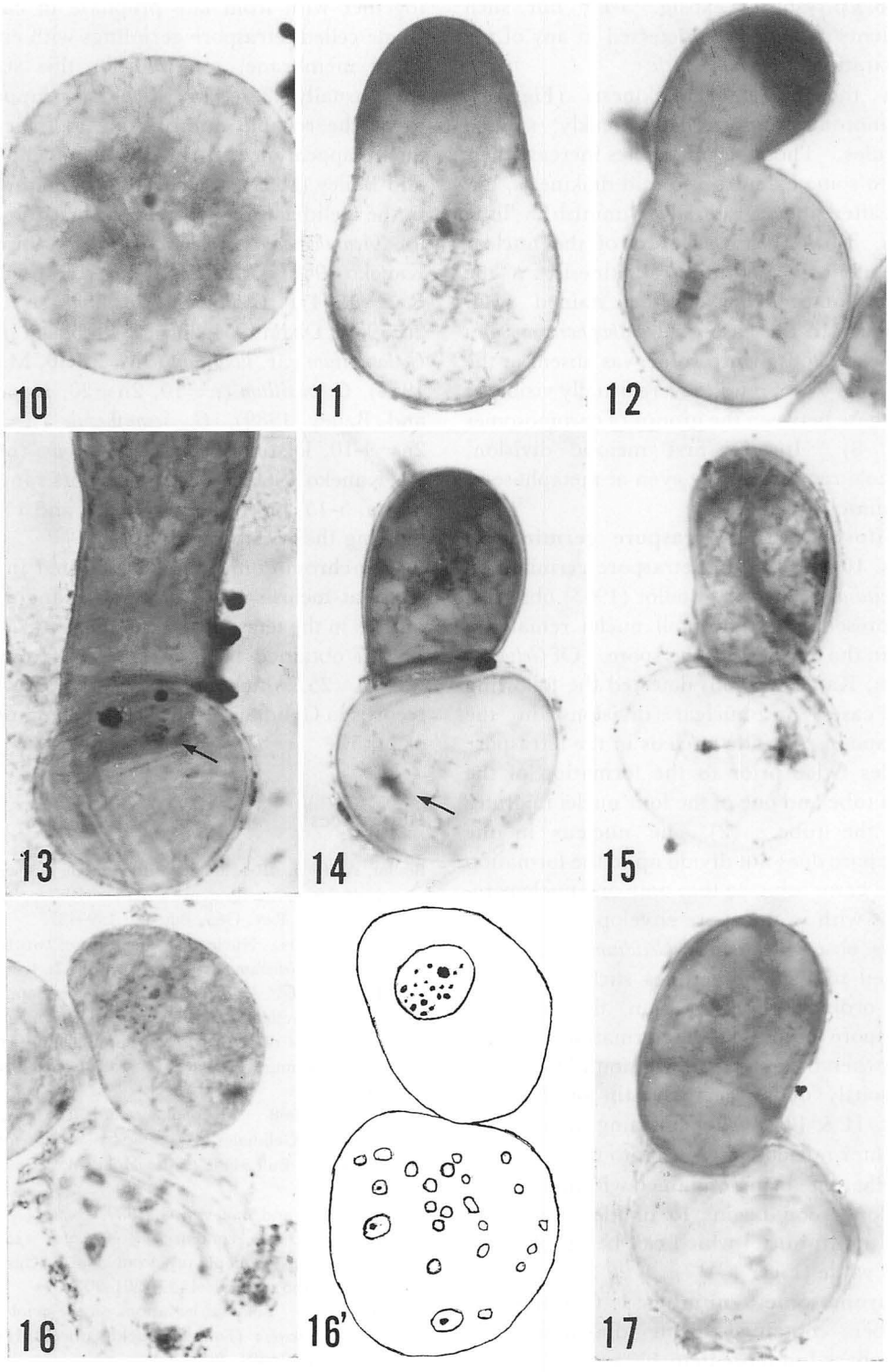
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(1968, p. 169, Text-fig. 3-F), but such bivalents could not be detected in any of my preparations for *G. amansii*.

At the onset of diakinesis (Fig. 1), chromosomes appear as weakly stained granules. Those chromosomes increase their size to some extent up to mid-diakinesis, but thereafter they gradually diminish a little (Figs. 3-6). With progress of the nuclear movement within diakinesis, the chromosomes come to be stained well. Similarly to the case of *Acanthophora japonica* (Kaneko 1968), centrosome was absent at the pole (Fig. 7). Spindles were usually visible at anaphase between the groups of chromosomes (Fig. 8). In the first meiotic division, nucleole remains rarely even at metaphase or anaphase (Fig. 9).

Mitosis in the tetraspore germination (Figs. 10-17): On the tetraspore germination of *Gelidium latifolium*, Boillot (1963) observed the presence of 6-8 small nuclei remaining within the envelope of the spore. Of *Gelidium vagum*, Kaneko (1968) detected the following two cases on nuclear divisions in the tetraspores: (1) The nucleus in the tetraspore divides twice prior to the formation of the germ tube and one of the four nuclei migrates into the tube. (2) The nucleus in the tetraspore does not divide up to the formation of the germ tube, so that only one nucleus remains with in the spore envelope.

My observations for *Gelidium amansii* indicated to have sometimes such two cases. But ordinarily, mitosis in the liberated tetraspore occurs at the formation of germ tube when the cytoplasm was found to be conspicuously dense near the tip of the tube (Figs. 11 & 12). After finishing mitosis, one daughter nucleus migrates into the tube, and the other one being remained within the spore envelope soon begins to divide to produce small multi-nuclei which can be visible for a short while (Figs. 13-17).

Chromosome number: Chromosome numbers obtained from diakinesis and metaphase I in more than 400 tetrasporangia, together with from late prophase in ca. 60 single-celled tetraspore germlings with empty spore membrane, totalized for this study, were usually 22-26, in which 25 is supposed to be the reliable number due to their frequent appearence. As shown by Kapraun and Bailey (1989), the chromosome numbers in the Gelidiaceae have been reported to date for *Acanthophora japonica* (n=15, 2n=30, Kaneko 1968), *Gelidiella acerosa* (n=4, 2n=8, Rao 1974), *Gelidium latifolium* (n=4-5, 2n=9-10, Dixon 1954; 2n=ca. 18, Boillot 1963), *G. latifolium* var. *luxurians* (2n=25-30, Magne 1964), *G. pusillum* (n=10, 2n=20, Kapraun and Bailey 1989), *G. sesquipedale* (n=4-5, 2n=9-10, Dixon 1954) and *G. vagum* (n=7-10, Kaneko 1966). Those numbers range in n=ca. 5-15, most likely n=5, 10 and 15, indicating the possibility of x=5.

The chromosome number counted in this study at meiosis I in the tetrasporangia and mitosis in the tetraspore germlings of *Gelidium amansii* obtained from Hakodate, Hokkaido was n=25 which is above the previous records in Gelidiaceae and also likely multiple of x=5.

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簸　　淵：マクサの四分胞子嚢と四分胞子発芽体における核分裂

北海道函館市立待岬で採集した紅藻マクサの四分胞子嚢と四分胞子発芽体で核分裂を観察した。固定には酢酸・アルコール（1：3）を用い，染色は酢酸・鉄・ヘマトキシリン・抱水クロラール液で行った。その結果，四分胞子嚢内第1核分裂前期にはディアキネシス期の前に拡散期が存在し，四分胞子発芽に際しては四分胞子が発芽管を形成する時に通常四分胞子内で核分裂が行われ，核分裂終了後1核は発芽管内に移行し，他の1核は原胞子内に留ってそこで分裂を始めて多数の小核が生じることを認めた。四分胞子嚢内第1回核分裂のディアキネシス期と中期，並びに細胞期四分胞子発芽体内の核分裂像から22–26の染色体数が得られたが，その出現頻度から本種の染色体数は n＝25 と想定された。（041 函館市港町3丁目1–1　北海道大学水産学部水産植物講座）