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Notes on *Urospora penicilliformis* ARESCHOUG from Hakodate, Hokkaido

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Observations were made with reference to the chromosomes of *Urospora penicilliformis* Areschoug (Chlorophyta, Cladophorales) from Hakodate, Hokkaido. The chromosome counts were 12 in the zygote-germlings, and 6 or 12 in the zoospore-germlings, indicating to have haploid and diploid zoospores released from the filaments.

Key Index Words: Chromosome—Cladophorales—cytology—Urospora penicilliformis.

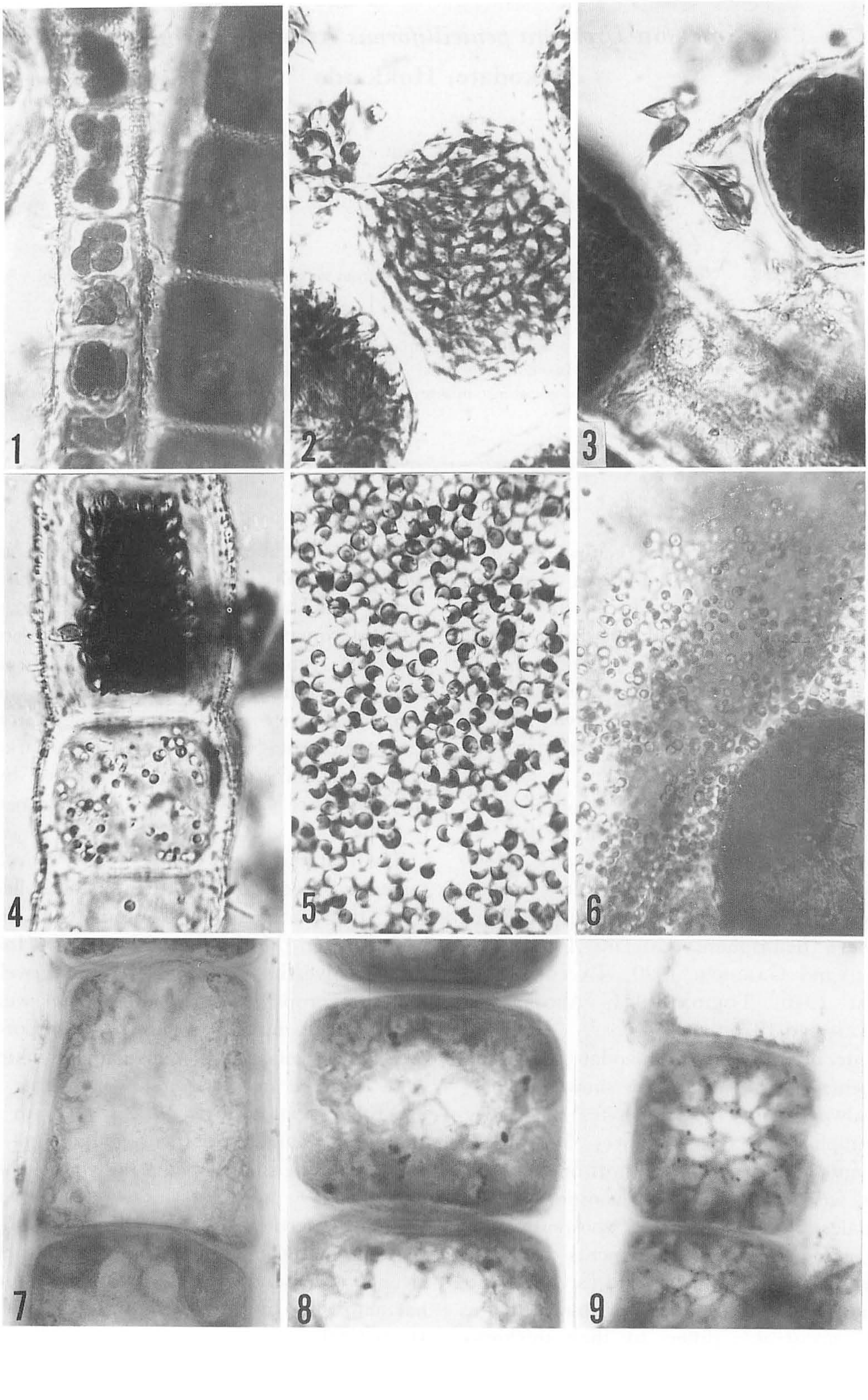
The species in the genus *Urospora* (Cladophoraceae, Chlorophyta) is of interest in having Codiolum stage in the life history (JORDE 1933, KORNMANN 1961a, b, 1966, NAGATA 1971). This genus comprises more than 10 species in the world, but none of the cytological events have been given except some mitotic figures in the vegetative cells of *U. incrassa* by KANNO (1936).

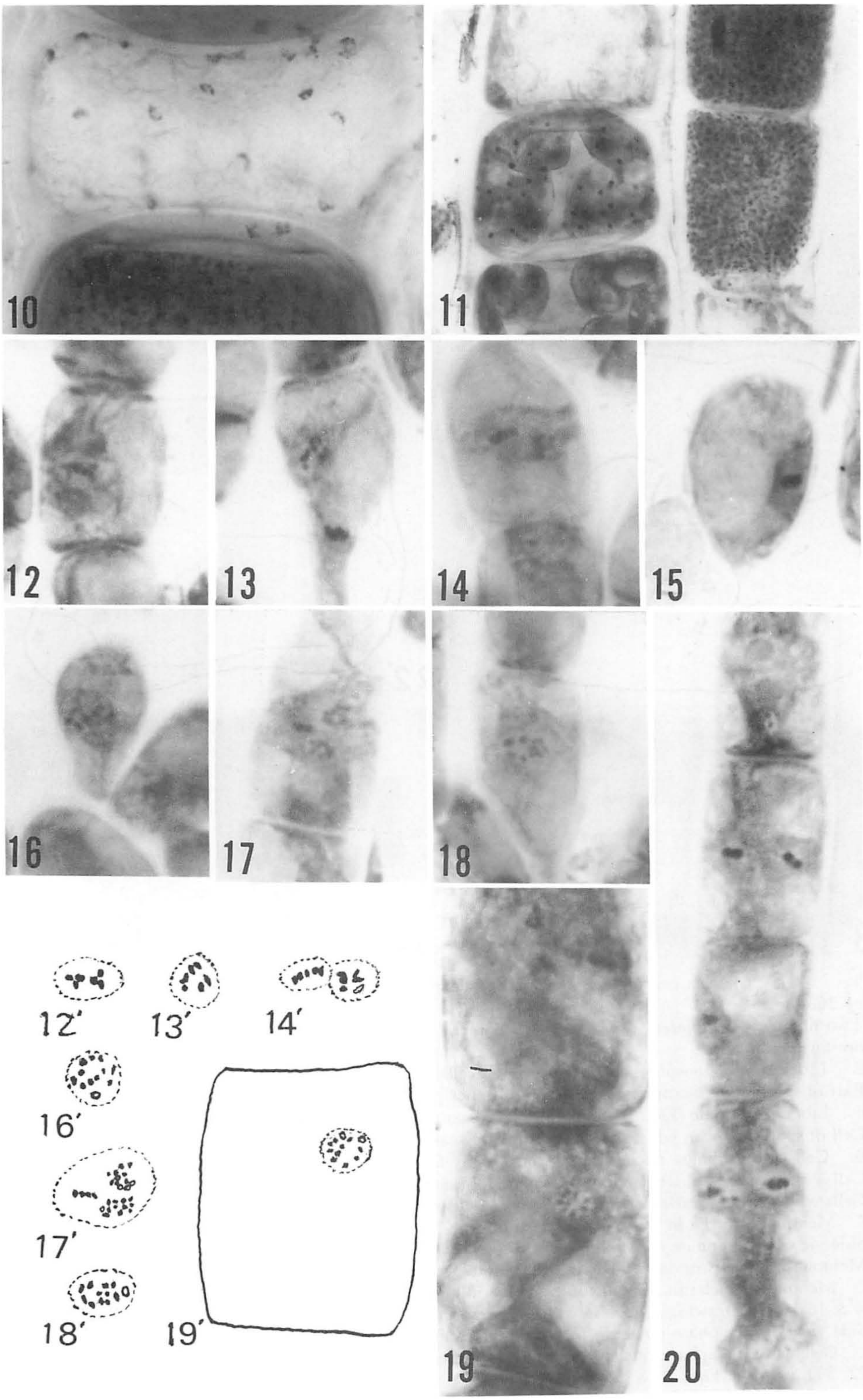
The present paper informs some observations with reference to cytology for *U. penicilliformis* ARESCHOUG at Hakodate, Hokkaido. This species is distributed widely along the coasts generally in the north of the northern hemisphere (COLLINS 1909, SETCHELL and GARDNER 1920, TAYLOR 1937, NAGAI 1940, TOKIDA 1954, ABOTT and HOLLENBERG 1976, etc.).

In my observations at Hakodate, the fertile filaments of *U. penicilliformis* showed to present always plenty of sporophytes, but scanty gametophytes. For instance, 500 fertile filaments collected from Shinori on May 28, 1979, were made up of 412 zoosporophytes, 26 males, 30 females and 32 zoosporophytes with gametangia. The filaments are quite varied in thickness not beyond ca. 100 μ and the number of zoospores or gametes in the cells considerably differs by their thickness (Figs. 1–4). The zoospores and gametes are released en mass or one by one through a pore. In the latter case, zoospores are always released from portion of the tail, and on liberation (Fig. 3) they turn round quickly to begin active swimming. Zoosporangia and gametangia are easily distinguishable even in the juvenile stage; the formers are darker green in colour and coarse in structure, but the latters are yellowish green and more or less fine.

The materials used for cytology were obtained at Shinori in May 1979. After collection, the materials were brought to the laboratory in the Faculty of Fisheries, Hokkaido University. In the laboratory, well-mature sporophytes and gametophytes were selected for fixing and for culture. Zoospores or zygotes of male and female gametes which were obtained from those shown in Figs. 5 and 6 had been cultured in ESP medium at 10°C under 3000 lux. In my culture, all of their germlings developed into young thin filaments.

Both the fertile filaments collected and the spore-germlings in culture were fixed in aceto alcohol (1:3) and stained with aceto-iron-haematoxylin-chloral hydrate solution (WITTMANN 1965).

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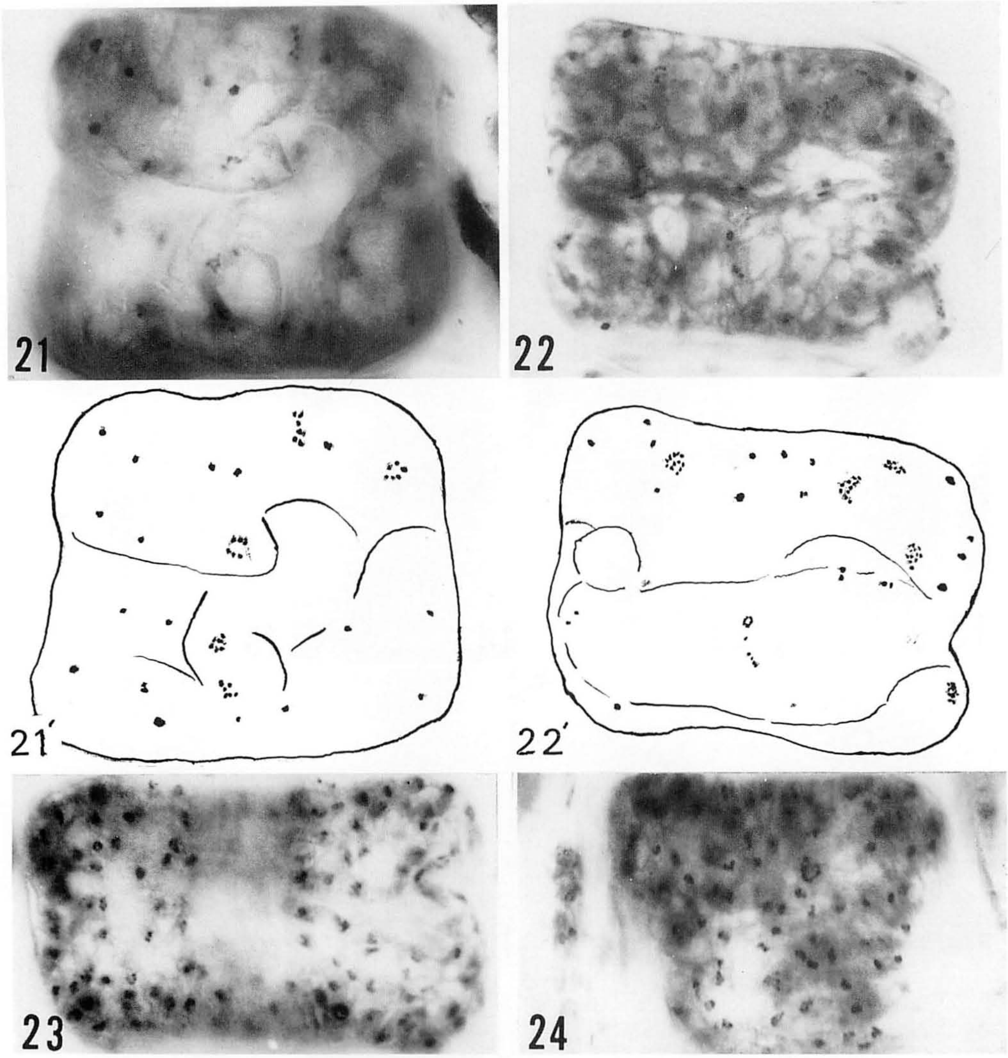

Figs. 1–24. *Urospora penicilliformis* ARESCHOUG collected from Hakodate, Hokkaido. Fig. 1, ×310; Figs. 2–24, ×560.

1. Two filaments in different thickness. The filament in the left side is a sporophyte bearing cells leading to zoospore-formation.
2 & 3. Liberation of zoospores through a pore of cells.
4. Part of sporophyte bearing zoosporangium (upper portion) and male gametangium (lower portion).
5 & 6. Liberated female (Fig. 5) and male (Fig. 6) gametes. Zygotes from those gametes were used for culture.
7. Cell of sporophyte, in which pyrenoids turn to weak in staining at the beginning of nuclear divisions.
8 & 9. Cell with prophase nuclei leading to zoospore-formation.
10. Cell with prophase nuclei leading to gamete-formation.
11. Cells with dividing nuclei leading to zoospore (left in the figure) and gamete-formation (right in the figure).
12–14. Metaphase nuclei in the zoospore-germlings.
15. Side view of metaphase nucleus in one-celled stage of zoospore-germling.
16. Metaphase nucleus in one-celled stage of zygote-germling.
17–19. Metaphase nuclei in the cells of zygote-germlings.
12′–14′ & 16′–19′. Drawings of 12–14 & 16–19, respectively.
20. Side view of metaphase nuclei in the young filament of zygote-germling.
21–24. Cells with metaphase nuclei leading to zoospore-formation.
21′ & 22′. Drawing of Figs. 21 & 22, respectively.

In both the vegetative and reproductive cells, the nuclear divisions occurred simultaneously (Figs. 7–11 & 21–24). In the germlings composed of less than about 20 cells, the same nuclear phases appeared occasionally in all of the cells (Fig. 20). When the nuclear divisions set in, pyrenoids came to weak in staining and nuclei began to grow larger (Figs. 7 & 8). With advance of the divisions, the pyrenoids completely disappeared, and the nuclei turned to be more and more stained well (Fig. 10). The metaphase nuclei in which chromosomes were countable were encounterd in the vegetative cells of the spore-germlings and in the zoosporangial cells. Each chromosome was uniform, minute, subspherical with diameter of ca. 1.5 μm in vegetative cells, but smaller in zoosporangia. Of the materials with metaphase nuclei, I found either 6 or 12 chromosomes in both the zoospore-germlings and zoosporangia, but 12 chromosomes in the zygote-germlings (Figs. 12–24).

Thus, the filaments of *U. penicilliformis* growing at Hakodate are obvious to have two kinds of zoospores, diploid or haploid. The chromosome numbers could not be ascertained in the gametangia, but it was suggested that the diploid filaments would be derived from either zoospores or zygotes. From the tables of 1.6 shown by Godward (1966) it is recognized that *U. penicilliformis* (n=6; 2n=12) has the smallest chromosome number in the species of Cladophorales hitherto reported, which is identical to *Cladophora flexuosa* Harv., *Cl. sericea* Kütz., *Cl. rupestris* Kütz., *Spongomorpha lanosa* Kütz., *Acrosiphonia traillei* Batt., *Chaetomorpha area* Kütz., and *Ch. metagonium* Kütz. In the present study, I could not succeed to obtain Codiolum stage in the culture of zoospores and zygotes perhaps due to the unsuitable culture conditions, and also to ascertain the occurrence of meiosis in any zoosporangial cell in the filaments. It is thinkable that the meiosis of this alga would take place at the formation of zoospores within the Codiolum stage. This is an interesting problem to be solved.

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籔　　凞：北海道函館産のシリオミドロについて

北海道函館産の緑藻シリオミドロについて主として細胞学的研究によって得た知見を記述した。採集した藻体並びに遊走子と接合子を培養して生じた発生体とを醋酸・アルコールで固定し，醋酸・鉄・ヘマトキシリン・抱水クロラール液で染色し，藻体の遊走子嚢内核分裂で6又は12個，遊走子発芽体で同じく6又は12個の染色体を，接合子発芽体では12個の染色体を観察し，遊走子には n 又は 2n の核を有する2種類があることを確かめた。
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