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PHYCOLOGICAL OBSERVATIONS II
ON THE STRUCTURE OF *PORPHYRA ONOI* UEDA

BY

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(With Plate II)

A vegetative cell of the red algae belonging to the order Bangiales is well known to have usually a single central stellate chromatophore with one pyrenoid at the center. This character has been reckoned as one of the characteristics of the order or at least of the family Bangiaceae. (Cf. FR. SCHMITZ, Bangiaceae in *Natürliche Pflanzenfamilien*, 1896, p. 308; DE TONI, *Sylloge Algarum*, IV, 1897, p. 5; G. S. WEST & FRITSCH, *British Freshwater Algae*, 1927, p. 415; G. M. SMITH, *Fresh-Water Algae of the United States*, 1933, p. 120).

The order Bangiales in the current system includes three families, viz., Bangiaceae, Rhodochaetaceae (incl. only one genus, Rhodochaete) and Compsopogonaceae (incl. only one genus, Compsopogon), and 14 genera in all, of which 7 genera in Bangiaceae containing about 77 species are described to have the typical chromatophore. But the remaining two families as well as 4 genera containing about 10 species in Bangiaceae are reported to have several discoid or band-shaped chromatophores. In the genus *Porphyra*, which is of course included in the above mentioned 7 genera, a different type of chromatophore has never been reported so far as the writer is aware. Among the Japanese species of this genus, *Porphyra tenera* KJELLM. was studied cytologically by Prof. M. ISHIKAWA¹, and its chromatophore was revealed to be also typical. In 1930 about the middle of March the writer observed two species of *Porphyra*, viz., *P. yezoensis* UEDA and *P. Onoi* UEDA, collected at Oshoro Bay, near Otaru Harbour, Hokkaido. While the former proved to be typical in the structure of the chromatophore, the cells of the latter, in the monostromatic part of frond, each contained two eccentric chromatophores as shown in Fig. 2. This quite peculiar feature of the cell content strongly attracted the attention of the writer,

1. M. ISHIKAWA, Cytological Studies on *Porphyra tenera* KJELLM. I. Bot. Mag., Tokyo, Vol. 35, pp. 206-218, 1921.

[Trans. Sapporo Nat. Hist.Soc., Vol. XIV, Pt. 2, 1935]

so that he formed the intention to carry on the study of the structure of this interesting alga.

Fronds of *Porphyra Onoi* are for the most part monostromatic, but often exhibit a distromatic character in certain portions of the frond. The distromatic portions are yielded by the oblique-transverse division of the monostromatic cells, and two halves of the latter each contain only one chromatophore, not central but somewhat parietal (Cf. Fig. 3).

A cross section of a young frond at the marginal portion is illustrated in Fig. 1. A few cells, one to several, at the edge of the frond each contain a single typical chromatophore. In other cells in the marginal portion, the chromatophore soon divides into two halves which gradually separate from each other and become parietal in position as the cells grow large.

The double nature of the chromatophore in the monostromatic cells was also demonstrated in the carpogonal cells as well as in the basal ones which produce rhizoidal filaments, as shown in Figs. 4 and 6.

In the spring of last year the cultivation of the carpospore was undertaken by Mr. TANEJI MASHIKO, a student of the School of Fishery, under the direction of the writer. A fertile frond was laid in a cultural dish on the 22nd of March. After a few days liberated carpospores were noticed on the bottom of the dish, then the algal frond was removed. By this cultural experiment it was confirmed that liberated carpospores of *Porphyra Onoi* set up germination sooner or later after they have settled on a substratum. On the 22nd of May, that is to say about two months after the inoculation, the sporelings were examined. They proved to be unicellular as yet and they were provided with a short germinating tube. One of such sporelings containing two parietal stellate chromatophores is illustrated in Fig. 5.

The foregoing is a brief description of the structure of *Porphyra Onoi*. As to the chromatophore of distromatic species or the subgenus *Diploderma* the writer has no information up to this day. In May 1934 the writer was fortunately able, at Muroran, to examine the chromatophore of *Porphyra variegata* KJELLM., which belongs to that subgenus. In the cross section of its frond, the chromatophore was discovered to bear striking resemblance to that of the distromatic cells of *Porphyra Onoi*. In other words it was not in the center of the cell but somewhat parietal, leaving the inner half of the cell content colourless.

At present the number of observed species is by no means sufficient to justify a discussion of the general morphology of the genus *Porphyra*. However, at least it may be said that *P. Onoi* represents an intermediate form between two subgenera, *Euporphyra* and *Diploderma*, not only in having a

monostromatic frond intermixed with distromatic portions but also in the structure of the chromatophore. Based on this intermediate form the writer proposes to establish a new subgenus, *Diplastidia*.

Now, three subgenera in the genus *Porphyra* might be defined as follows:

Subgenus 1. *Euporphyra*, ROSENVINGE¹. Frond is generally composed of one layer of cells containing a single axial plastid. Hereinunder belong *P. tenera*, *P. yezoensis* and perhaps also many of the other monostromatic species.

Subgenus 2. ***Diplastidia***, subgen. nov. Frond is for the most part composed of one layer of cells containing two plastids, and in portions it is often distromatic.

Represented at present by only one species, *P. Onoi*.

Subgenus 3. *Diploderma*, (KJELLMAN²) ROSENVINGE¹. Frond is generally composed of two layers of cells containing a single plastid, not axial but lying in one side of the cell, front to the surface of the frond.

Hereinunder belong *P. variegata* and very probably other distromatic species.

As preserved specimens of a *Porphyra*, dry or wet, unless they are previously well fixed with some suitable reagent, can scarcely retain the cell content in its natural condition, it is almost impossible to determine the nature of the chromatophore when fresh materials are beyond reach. This is probably one reason why such a distinct type of the chromatophore of *P. Onoi* has been overlooked by previous investigators, and why the possession of "a single central chromatophore", if it was really the commonest and most familiar type, has been thought, in spite of the scarcity of actual observation, to be the general rule in the genus *Porphyra*.

There remain at least two problems which must be solved before a discussion of the relations among the three subgenera above defined can be entered into.

1.) What is the structure of the chromatophore of a species in subgen. *Euporphyra* which is in portions sometimes or rarely distromatic?

2.) Species in subgen. *Diploderma* are often monostromatic while young, and sometimes even in the adult frond are also monostromatic at the margin. What is the type of the chromatophore in such monostromatic portions?

1. ROSENVINGE, L. K., Grönlands Havalger. Meddelelser om Grönland, III, 1893.

2. KJELLMAN, F. K., The Algae of the Arctic Sea. K. Sv. Vet.-Akad. Handl., Bd. 20, No. 5, p. 188 (as a generic name), 1883.

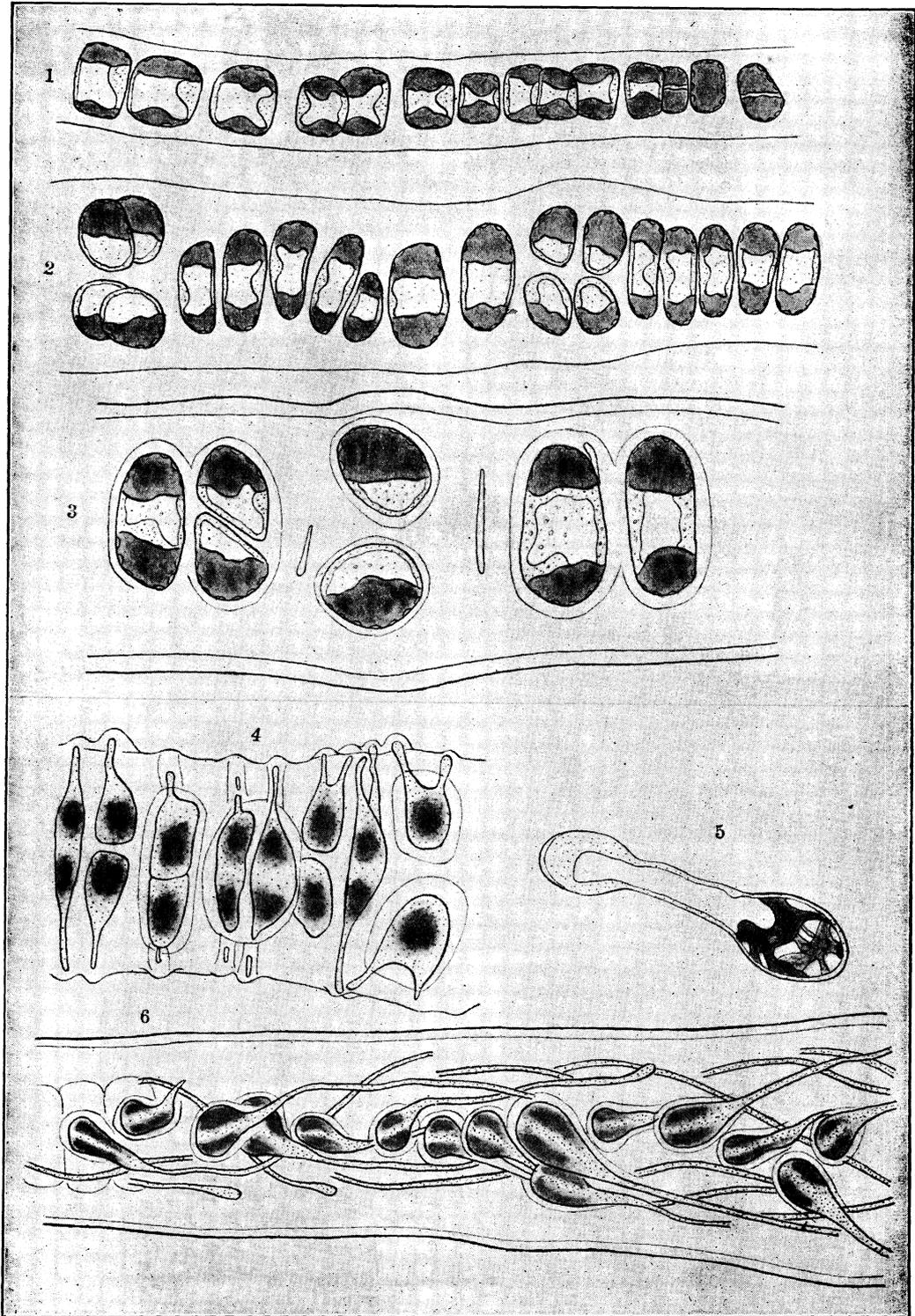
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- Fig. 1. Section through marginal portion of a young frond. $\times 600$.
 Fig. 2. Section through vegetative portion of a mature frond. $\times 325$.
 Fig. 3. do. $\times 600$.
 Fig. 4. Section through mature portion (female) of a frond, showing carpogonial cells. $\times 426$.
 Fig. 5. A germinating carpospore. $\times 718$.
 Fig. 6. Section through basal portion of a frond, showing rhizoidal cells. $\times 325$.

摘 要**藻 類 観 察 II**

紅藻類のウシケノリ族又は少くともウシケノリ科の特徴の一つと一般に認められてゐるのは、各細胞内の中心に一個の星形の色素体を有する性質であつて、該科に屬するアマノリ屬 (*Porphyra*) にては、之れと違つた型の色素体が記載された例を知らない。所がオホノノリ (*Porphyra Onoi* UEDA) に一つの新しい型を發見したので之れを記載し、且つ、本種を土台として新亞屬 *Diplastidia* を設け、從來の二亞屬 *Euporphyra* 及び *Diploderma* の中間型なることを論じ、此の三亞屬に夫々新たに定義を與へた。



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