The Gonimoblast Development In Ceramiaceous Algae Of Japan II

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THE GONIMOBLAST DEVELOPMENT IN CERAMIACEOUS ALGAE OF JAPAN. II.*

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Wrangelia sp.**

As to the gonimoblast development of the genus *Wrangelia*, only *W. penicillata* has been studied by Bornet & Thuret (1880), Zerlang (1889) and more precisely by Kylin (1925, 1928a). However, their results were not so complete on some points even in Kylin's study. The chief difficulty of the observation seems to lie in the condensation of ramuli in the fertile part of this genus. Some years back the writer was offered a material of this genus collected from Sanuki by Mr. Y. Ujike, and fortunately this unknown species of *Wrangelia* does not show such condensation of the fertile portion. As a result of the research of it the writer has been able to trace exactly the development of the female organs.

The fertile part of this alga shows a considerably differentiated axis. Such axis is composed of 5–15 small segment cells and it is tetrastichously ornated by the small celled branchlets forming a dwarf twig (Fig. 1, A). Three procarps in group arise successively out of the central cells near the apex of each fertile axis (Fig. 1, B, C). The procarp is composed of the 4–(rarely 5–) celled carpogonial filament and its supporting cell (Fig. 1, D, E). The latter corresponds to a pericentral cell in the fertile axis and has no sterile cell unlike *W. penicillata* studied by Kylin. The

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pericentral cell is to be compared with the sterile branchlet. The four-celled carpogonial filament possesses an apical carpogonium ending in a long trichogyne, and shows a characteristic contortion

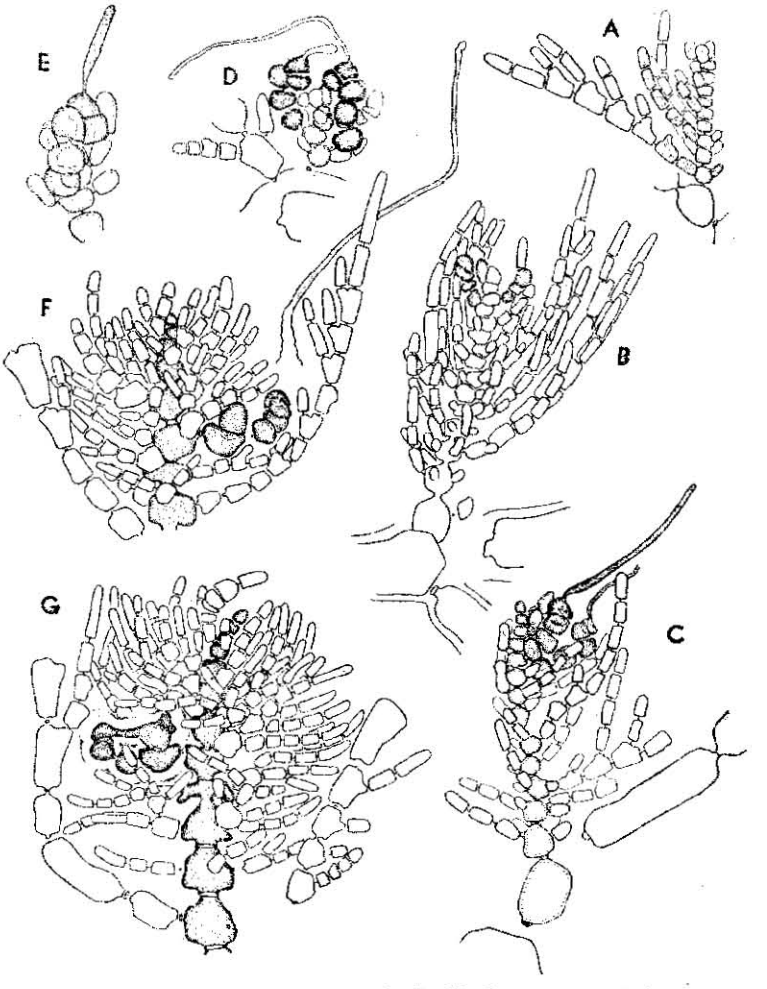

Fig. 1. *Wrangelia* sp. A—D, F, G. ×210
E. ×350

near the hypogynous cell. In the advanced stage the lateral branchlets surrounding the fertile axis branch repeatedly. In the cystocarp formation they together become a ball in outline enclosing the gonimoblast filaments.

After fertilization the supporting cell itself grows largely upwards and it divides obliquely into two portions: the lower portion known as the basal cell and the upper portion being the auxiliary cell (Fig. 1, F). Then the auxiliary cell is connected by a long passage with the carpogonium (Fig. 1, G). Namely they fuse directly without any intermediator such as a connecting cell.

Thus the auxiliary cell connected with the carpogonium begins to grow upwards and produces an initial cell of gonimoblast filaments. From the cell the rhizoidal gonimoblast filaments are issued. As to the further development, the writer's observations coincide almost with the works of the above mentioned algologists.

The genus *Wrangelia* had been usually regarded as a member of the family *Gelidiaceae*. Later, Kylin removed the genus into the *Ceramiaceae*, a family belonging to the order *Ceramiales*, for two reasons as follows: (1) the alga has the typical auxiliary cell, and (2) after fertilization the cell in question is divided from the supporting cell. These respects have been ascertained also in the present study.

Kylin (1930) supposed two phylogenetic groups in *Ceramiaceae*. In one group of which *Wrangelia* was counted with *Antithamnion*, *Platythamnion* and *Ceramium*, and furthermore he said a follows: "*Wrangelia* steht in vegetativer Hinsicht auf etwa derselben Entwicklungshöhe wie *Antithamnion* und *Platythamnion*." "In bezug auf die Prokarpienbildung steht *Wrangelia* einer etwas höheren Entwicklungstufe also *Antithamnion*." Thus the consideration that *Wrangelia* is to be placed higher than *Antithamnion* etc., was chiefly based on the vegetative characters and the development of procarp.

In addition, the fact that the fusion between the fertilized carpogonium and the auxiliary cell is directly held by a passage, seems also to support Kylin's opinion mentioned above, on the phylogenetic position of the genus in question. The writer wants to show its reason by citing Kylin's words (1928 b) as follows: "Die Familie *Ceramiaceae* repräsentiert die unterste Stufe der Entwicklung der Ordnung *Ceramiales*. ..... Betreffs der sporogenen Fäden zeigt sich auch die primäre Stellung dieser Gattungen, und zwar dadurch, dass besondere Zellen gebildet werden, welche die Verbindung zwissen dem Karpogone und der Auxiliarzelle vermitteln. Diese Zellen entsprechen den langge-

streckten sporogenen Fäden der Cryptonemieen. Bei höher stehenden Ceramiaceen (*Griffithsia* nach Kylin, 1916, S. 110) verbindet sich dagegen das Karpogon direkt mit der Auxiliarzelle."

Griffithsia venusta Yamada

The material of this study was collected by the writer from Susaki, Izu Province. It was a female specimen only so that the writer could not determine definitely its specific name. It bears a great likeness to *Griffithsia venusta* Yamada (1944) in some respects. Here the writer uses provisionally its specific name.

The fertile axis is produced on the shoulder of the penultimate or somewhat lower cell (Fig. 2, B). It consists of three differentiated cells (Fig. 2, A). These cells are very thin and extremely smaller than their mother cell or vegetative cells. Of the three the top cell is smaller and the basal one is larger. The middle cell becomes fertile and cuts off two pericentral cells. The one produced laterally cuts off again a small cell which is sterile, and then becomes the supporting cell of the four-celled carpogonial filament. The other produced outside becomes a sterile cell (Fig. 2, D).

After fertilization the supporting cell becomes the auxiliary mother cell, and cuts off an auxiliary cell upwards. The behaviour of the fertilized carpogonium in this stage is not certain. However it is worthy of mention that the carpogonium seems to produce a minute cell on the opposite side of the auxiliary cell (Fig. 2, E).

Then the auxiliary cell produces an initial cell of gonimolobe (Fig. 2, E). From the auxiliary cell other gonimolobes are successively produced (Fig. 2, F). On the other hand the basal cell of the fertile axis cuts off 5 small cells on the outside (Fig. 2, E). Each of them, furthermore, produces an inwardly curved cell which becomes an involucrum cell (Fig. 2, G).

Female organs of *Griffithsia*-species have been studied by many algologists. Among these Kylin's study (1916) on *G. corallina* is well known to us. The present species has a great likeness to *G. corallina* in the properties of the female organs, especially in having much differentiated 3-celled fertile axis growing on the shoulder of the upper vegetative cell. But it can be distinguished from *G. corallina* by the number of procarps in each fertile axis.

In *G. corallia* two procarps are produced from the middle cell of each fertile axis, while in this species only one is found as in *G. Bornetiana* etc.

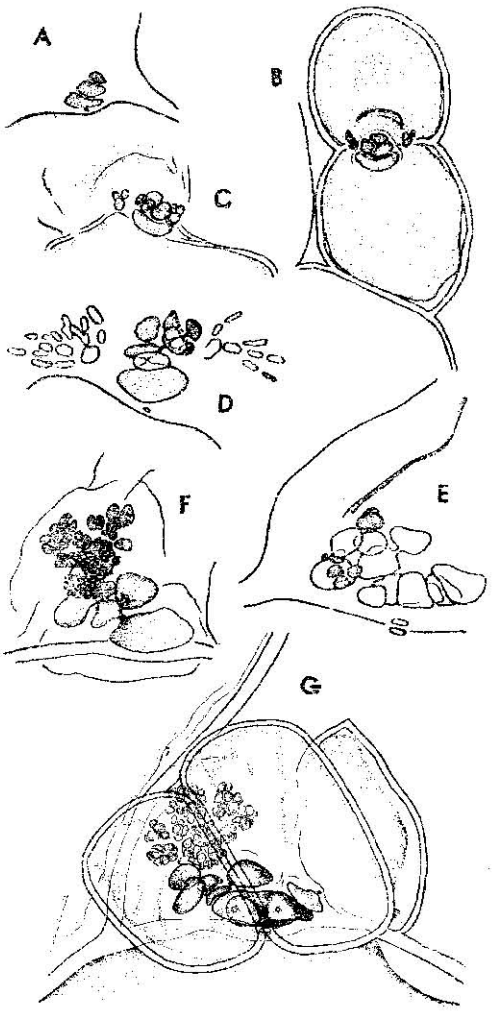

Fig. 2. *Griffithsia venusta.*
×250

As to the direct fusion between the auxiliary cell and the carpogonium mentioned by Kylin, unfortunately, the writer could not ascertain in the present study.

The writer wishes to express his hearty thanks to Prof. Dr. Y. Yamada for his kind direction. Thanks are also due to Prof. Dr. K. Uchida and Prof. Dr. I. Amemiya who helped him with much kindness.

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