MORPHOLOGY AND CYTOLOGY OF *POLYSIPHONIA PLATYCARPA* BOERGS.*

Preliminary Note

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THE only species of *Polysiphonia* that has been worked out in detail both as regards its developmental morphology and cytology is *Polysiphonia violacea* (Yamanouchi, 1906 A; 1906 B). Since then, the same species and a few other species of the genus have been worked out by other authors as regards their developmental morphology (Connolly, 1911; Kylin, 1923, 1937; Grubb, 1925; Rosenberg, 1933), but the cytological details were not followed by these workers.

Polysiphonia platycarpa Boergs. occurs in plenty in the estuarine portion of the river Adyar at Madras and in the back-waters at Ennur eleven miles north of Madras, and was therefore taken up for a detailed investigation. This species showed several interesting features:

(i) The carpogonial branch in this species is unique in being three-celled (Fig. 1), while in all other members of the Rhodomelaceæ so far investigated it is four-celled.

(ii) The fusion of the fertilised carpogonium with the auxiliary cell is effected by a small connecting cell cut off by the carpogonium (Fig. 5 *Con. C*). A connecting cell is usually absent in the Rhodomelaceæ though it has been previously recorded in two members of the family, *viz.*, *Polysiphonia decipiens* (Connolly, 1911) and *Laurencia pinnatifida* (Kylin, 1923).

(iii) Yamanouchi (1906 B, pp. 420–423) has described an extraordinary type of reduction division in *Polysiphonia violacea* during tetraspore formation. According to him the heterotypic division in this alga stops at anaphase and the homeotypic division begins where the heterotypic division ends. His description of reduction division is as follows: "The spindle of the first mitosis is of very short duration. As soon as the chromosomes at the equatorial plate separate into two groups, the two spindles of the second mitosis suddenly appear and the first spindle can no longer be recognised.... The second mitosis of the tetraspore-mother-cell, therefore, follows so shortly after the first that there is no period between for the organisation of two resting nuclei." In other words, the later stages of the

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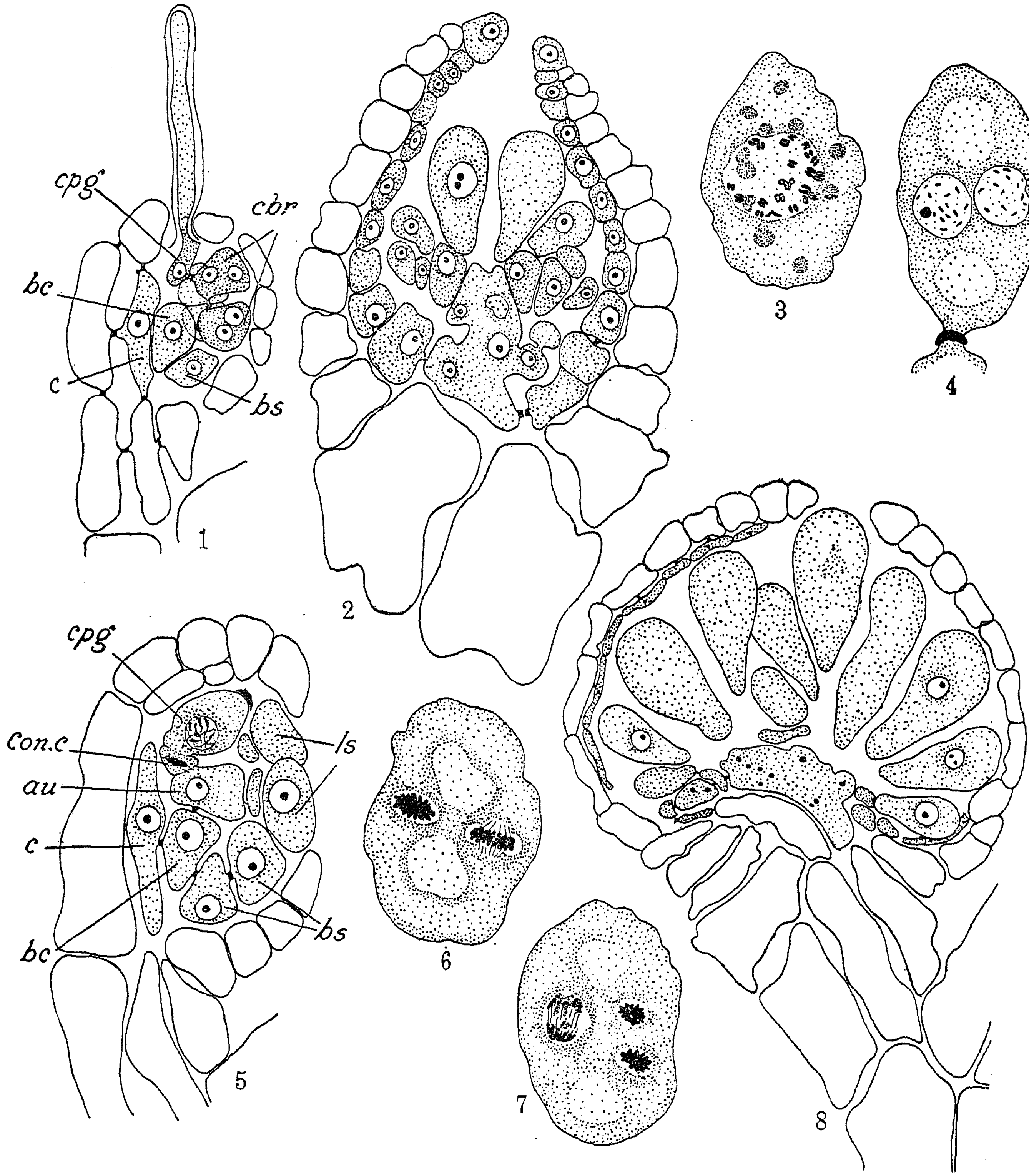
heterotypic division and the earlier stages of the homeotypic division are, as it were, completely dropped.

In the present form, however, no such extraordinary features were observed. The reduction division during tetraspore formation is quite normal. In the first division of the tetrasporangial nucleus, all the stages



Figs. 1–8. *Polysiphonia platycarpa* Boergs

Fig. 1. Procarp just before fertilisation, showing the bearing cell (*bc.*), basal sterile cell (*bs.*) and the three-celled carpogonial branch (*cbr.*); the two lateral sterile cells are shown behind the carpogonial branch. carpogonium (*cpg.*). ×900.

Fig. 2. Young cystocarp showing the two-layered cystocarp wall and its densely protoplasmic inner layer. ×600.

Fig. 3. Diakinesis in the tetrasporangium (only 20 pairs of chromosomes are seen in the section). ×1,125.

Fig. 4. Two-nucleate stage of the tetrasporangium. ×1,125.

Fig. 5. Section of procarp after fertilization, showing the auxiliary cell (*au.*), and the connecting cell (*con.c.*) between it and the carpogonium (*cpg.*). ×900.

Fig. 6. Metaphase of the second division in the tetrasporangium. ×1,125.

Fig. 7. Anaphase of the second division in the tetrasporangium. ×1,125.

Fig. 8. Ripe cystocarp with fully formed carpospores; note the wall is one-layered, with the remnants of the degenerating inner layer still sticking to it. ×600.

of the heterotypic division are gone through resulting in the formation of two daughter nuclei (Fig. 4). A definite interkinesis is seen after the first division before the commencement of the second division.

Again, according to Yamanouchi, the two spindles of the second division lie within the primary nuclear membrane which persists throughout the heterotypic and the homeotypic mitoses. In the present alga, unlike in *Polysiphonia violacea*, the two spindles of the homeotypic division lie separately in the tetrasporangium (Figs. 6, 7); the membrane of the tetrasporangial nucleus does not persist beyond the metaphase of the first division.

(iv) During the heterotypic mitosis, the tetrasporangial nucleus passes into an apparent resting stage after pachytene. Diakinesis (Fig. 3) is observed only after the tetrasporangium had enlarged considerably. During this enlargement, the tetrasporangial nucleus remains in an apparently resting condition. Such an intervention of an apparent resting stage between pachytene and diakinesis during reduction division is of very rare occurrence and has been recorded by Westbrook (1928, 1935) in *Rhodymenia palmata* and some other Florideæ. Similar resting stages during meiosis have been reported for some Phæophyceæ also, *viz.*, *Dictyota dichotoma* (Williams, 1904), *Padina pavonia* (Carter, 1927), and *Pylaiella littoralis* (Knight, 1923).

(v) The tetraspores appear to escape from the sporangium by squeezing themselves out through amæboid movement (Pl IX, Fig. 5).

(vi) The development of the cystocarp wall show certain interesting features. The cystocarp wall is two layered at the beginning (Fig. 2). Of these two layers, the outer layer is derived from the inner. During further development, the cells of the inner layer, which are rich in contents, gradually shrivel up and finally completely disappear, so that the wall of the mature systocarp is made up of only one layer of cells, *viz.*, the original outer layer (Fig. 8). The inner layer is evidently nutritive in function.

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Explanation of Plates

Figs. 1–8. *Polysiphonia platycarpa* Boergs.

Fig. 1. Growing apex of a female plant showing the apical cell and a young procarp initial. ×330.

Fig. 2. Young procarp showing the three-celled carpogonial branch (*C*) and the bearing cell (*B.C.*). ×950.

Fig. 3. Apical portion of male plant showing antheridial clusters. ×75.

Fig. 4. Habit of alga growing epiphytically on leaf of *Halophila ovalis*. About natural size.

Fig. 5. Portions of tetrasporic plant with tetrasporangia. Note the escape of tetraspores in one of the sporangia. ×150.

Fig. 6. Part of a female plant with a young and an old cystocarp. ×160.

Fig. 7. Section of tetrasporangium showing the metaphase of the second division. ×1,450.

Fig. 8. Section of young cystocarp showing the developing carpospores and the two-layered wall. ×350.

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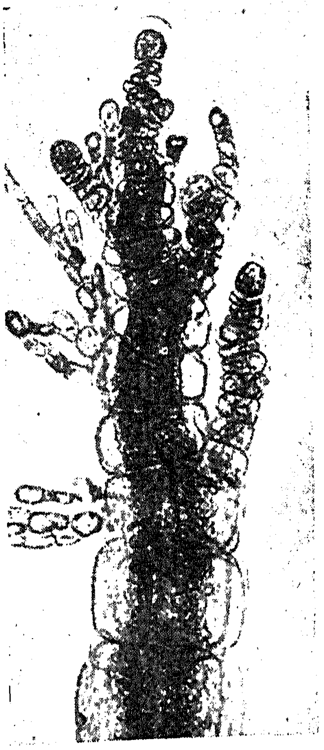

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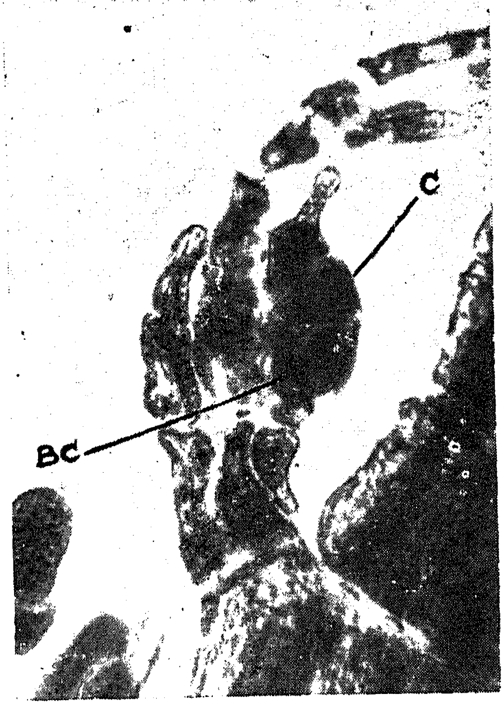

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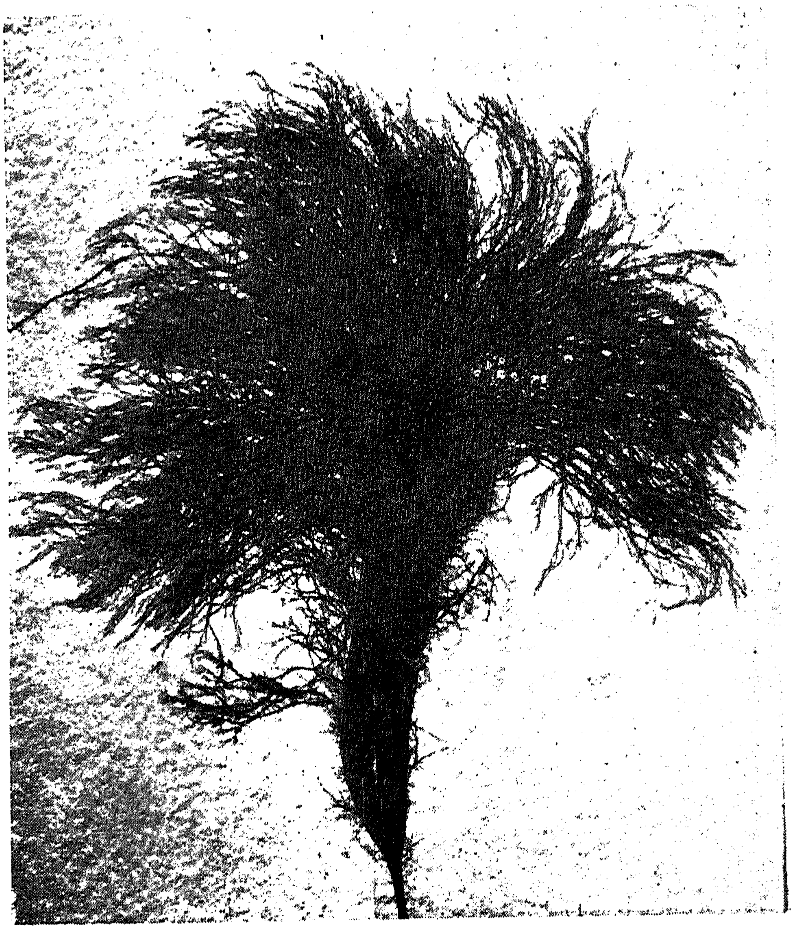

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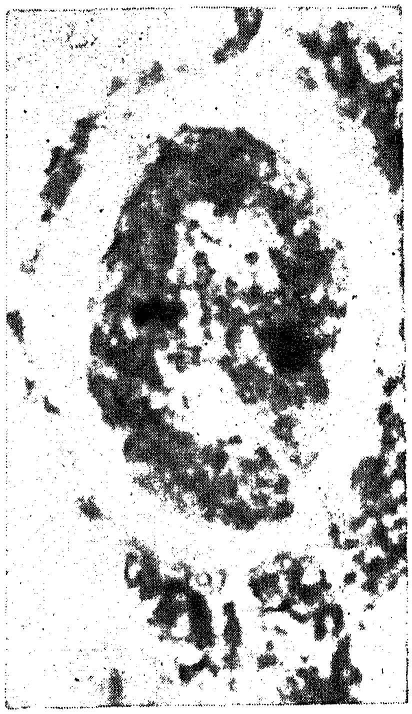

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