

## *Batrachospermum macrosporum* MONTAGNE from South America

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This paper deals with the occurrence of hypogynous cells which form rosette-like laterals, and the pronounced protoplasmic connections between the carpogonium and the hypogynous nutritive cell of *Batrachospermum macrosporum* MONTAGNE. The development of carposporophyte and the geographical distribution of this species in South America are also dealt with.

*Key Index Words:* *Batrachospermum macrosporum*—freshwater Rhodophyta—hypogynous cells—rosette-like laterals—South America.

*Batrachospermum macrosporum* was described by MONTAGNE (1850) based on the specimen collected by Leprieur from River Orapu and Comté in French Guiana. THÉRÉZIEN (1985) reported *Batrachospermum macrosporum* MONTAGNE from Crique Blanche, a tributary of River Orapu in French Guiana.

Recently, three collections of *B. macrosporum* were made from tropical, subtropical and temperate regions in Brazil.

Based on the Brazilian herbarium specimens, and comparing them with the type specimen of *B. macrosporum*, this paper deals with those elongated hypogynous cells that form rosette-like laterals, and the geographical distribution of *B. macrosporum* in South America.

### Herbarium specimens examined in the present study

Three Brazilian collections of *Batrachospermum macrosporum* MONTAGNE examined in this study were as follows: the herbarium specimen (SP 187859) collected from Araucária, State of Paraná (SUREHAMA, 05/03/1981), the herbarium specimen (SP 187184) collected from Santa Cruz River, Cardoso Island, Cananéia, State of São Paulo (VITAL, 15/

03/1984), and the herbarium specimen (SP 187855) collected from Igarapé Tarumanzinho near Manaus, State of Amazonas (NECCHI & KUMANO, 20/08/1986). The Brazilian specimens are deposited in the Herbarium of Instituto de Botânica, São Paulo in Brazil, and their duplicates are deposited in the Herbarium of Faculty of Science, Kobe University, Kobe in Japan.

The type specimen (LEPRIEUR No. 1105) of *Batrachospermum macrosporum* MONTAGNE, which was collected from River Orapu and Comté in French Guiana and deposited in Muséum National d'Histoire Naturelle in Paris, was also examined.

### Observations of the Brazilian herbarium specimens

The examinations of the herbarium specimens were as follows.

#### 1. Development of carpogonia and hypogynous cells

The carpogonium-bearing branch is composed of 3–7 barrel-shaped cells and arises from the pericentral cell (the basal cell of primary branchlets) and sometimes from the intercalary cells of the carpogonium-bearing

branch.

In the early stage of the development, the terminal portion of young carpogonium sticks out, and becomes a round initial of the trichogyne (Figs. 1, 2), then turns into the obovoidal or spatular-shaped trichogyne with an indistinct stalk (Figs. 3-5). A hypogynous cell elongates laterally and produces upward a protuberance, then a further protuberance is produced at the opposite side in the same manner (Figs. 3-5).

## 2. Development of carposporophyte

After fertilization, the trichogyne is separated from the basal portion of carpogonium (Fig. 6). The fertilized carpogonium extends lateral outgrowths and gonimblast filaments are produced (Fig. 8).

As the development of the gonimblast filaments progresses, the hypogynous cell becomes connected with the carpogonium (Fig. 7) through the widened pit connection. The protoplasmic connections between the carpogonium, the nutritive hypogynous cell and the underlying cells (Figs. 8, 11) of the carpogonium-bearing branch are especially pronounced. The gonimblast filaments (Figs. 10, 11) are composed of one or two, rarely three, barrel-shaped or cylindrical cells and are irregularly branched.

The gonimblast filaments produce terminally or subterminally obovoidal or subpyriform carposporangia (Figs. 11, 12), which are large, about 50  $\mu\text{m}$  long and about 30  $\mu\text{m}$  wide.

## 3. Germination of carpospores

Although the carposporangia are obovoidal or subpyriform, the carpospores are spherical after liberation. The carpospores are often observed to germinate within or near the carposporangia (Fig. 12).

Upon germination, an outgrowth arises from one side of the carpospore facing the proximal portion of the carposporangium and develops into a germ tube (Fig. 13), which is cut off by a septum to form the initial cell of the germling (Figs. 12, 14). When the germling develops two cells (Fig. 15), an outgrowth

arises from the cell next to the original carpospore (Fig. 16). The filaments of the germlings elongate toward the center of the carposporophyte (Fig. 12).

On the contrary, a branch of the *Chantrasia*-stage elongates towards the opposite direction of the germling (Figs. 18-20, 23-25), or toward the outer side of the whorl (Fig. 12).

Monosporangia are produced on a lateral branch of juvenile *Chantrasia*-stage (Figs. 20, 25).

## Discussion

### 1. Identification of the species

The type specimen of *Batrachospermum macrosporum*, examined in the present study, was accompanied by the figures of 'spora', which were drawn by Montagne with a pencil, however, they have not been published yet. Moreover, Montagne did not describe or show any female organs such as the carpogonium, because no sexual organs had been found in any taxa of the Rhodophyta at his time. Giving no text figures, MONTAGNE (1950) described *B. macrosporum* based on the specimen collected from River Orapu and Comté in French Guiana, and stated that "spora matura deorsum acuminatae (obovoideo-subpyriformae), 5 ad 6 centimillim. (50-60  $\mu\text{m}$ ) longae apice 4 centimillim. (40  $\mu\text{m}$ ) crassae". STRODOT (1884) and SKUJA (1933) referred to *B. macrosporum*, giving no dimensions and no text figures of carpospores.

With text figures of female organs and carposporangia, THÉREZIEN (1985) reported that the carposporangia are 51  $\mu\text{m}$  long and 31  $\mu\text{m}$  wide, based on the specimen of *B. macrosporum* collected from Crique Blanche, a tributary of River Orapu in French Guiana. Carposporangia of the Brazilian specimens of *B. macrosporum* examined in the present study are acuminate downward, obovoidal or subpyriform, about 50  $\mu\text{m}$  long and about 35  $\mu\text{m}$  wide.

Comparing the type specimen and the Brazilian herbarium specimens of *B. macrosporum*, it was found that the Brazilian

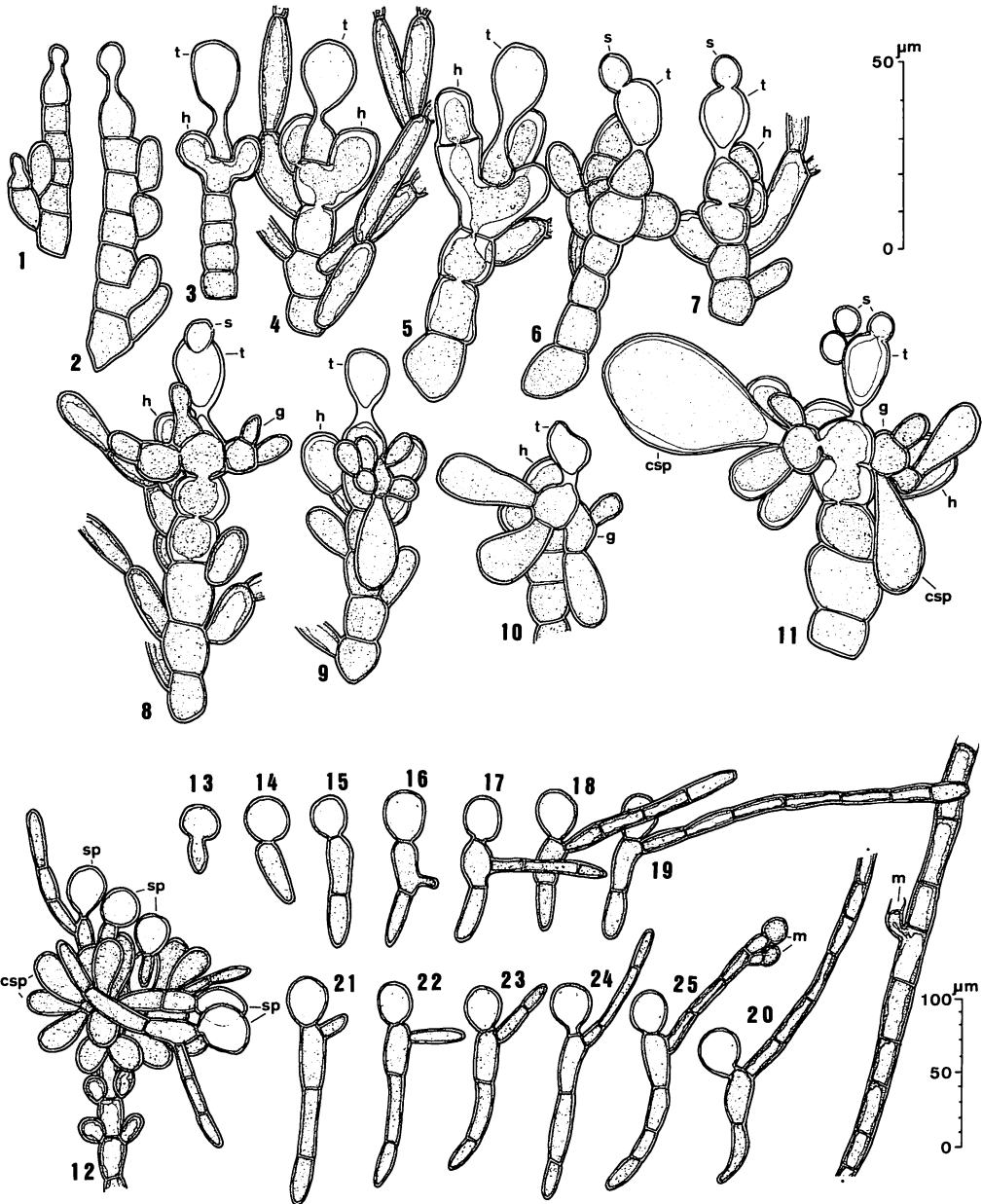


Fig. 1–25. *Batrachospermum macrosporum* MONTAGNE

Fig. 1–4. Development of a carpoogonium and hypogynous cells elongated to form rosette-like laterals. Fig. 5. A mature carpoogonium with an obovoidal trichogyne and well-developed hypogynous cells. Figs. 6, 7. Fertilized carpoogonia. Fig. 8. Gonimoblast filaments arising from a fertilized carpoogonium. Fig. 8. Gonimoblast filaments arising from a fertilized carpoogonium, and protoplasmic connections between a carpoogonium, a hypogynous cell and an underlying cell. Figs. 9, 10. Young carposporophyte. Fig. 11. Obovoidal or clavate carposporangia. Fig. 12. Carpospores germinating *in situ*. Figs. 13–20. Germlings with a branch arising from the cell next to the carpospores. Figs. 20, 25. Germlings with the branch of juvenile *Chantransia*-stage, bearing monosporangia. cps, carposporangia; h, hypogynous cells; g, gonimoblast filaments; m, monosporangia; s, spermatia; sp, carpospores; t, trichogynes.

herbarium specimens are identical with the type specimen in the main characteristics such as the shape of female organs and the size of carposporangia.

Results of the present observations agreed with the description and text figures of female organs and carposporangia shown by THÉRÉZIEN (1985). Therefore the Brazilian herbarium specimens is identified as *Batrachospermum macrosporum* MONTAGNE.

## 2. Assignment of the species

RATNASABAPATHY and KUMANO (1982) described *Batrachospermum hypogynum* in Malaysia and reported the occurrence and the development of rosette-like laterals of hypogynous cells in this species.

*B. macrosporum* differs from *B. hypogynum* in the shape and the size of trichogyne. The carpogonium is about 10  $\mu\text{m}$  wide at the base, about 15  $\mu\text{m}$  wide at the apex, 35–40  $\mu\text{m}$  long, and trichogyne is obovoidal or spatular-shaped in *B. macrosporum*, while the carpogonium is about 8–10  $\mu\text{m}$  wide at the base, about 10–13  $\mu\text{m}$  wide at the apex, 40–45  $\mu\text{m}$  long, and trichogyne is urn-shaped in *B. hypogynum* (RATNASABAPATHY and KUMANO 1982). These two species, however, resemble each other in having hypogynous cells forming rosette-like laterals and large carposporangia.

*B. macrosporum* has been assigned to the section *Aristatae* together with *B. cayennense* MONTAGNE by SKUJA (1933). However, *B. macrosporum* is properly placed in a separate section rather than in the section *Aristatae* together with *B. hypogynum*.

## 3. Geographical distribution of the species in South America

As mentioned previously, the type specimen of *B. macrosporum* was collected by Leprieur from River Orapu and Comté in French Guiana. The type locality of *B. macrosporum* is situated at latitude 5 degrees north in a tropical region. THÉRÉZIEN (1985) collected the specimens of *B. macrosporum* from Crique Blanche, a tributary of River Orapu in French Guiana.

The localities of three Brazilian collections examined in the present study are as follows: Igarapé Tarumazininho near Manaus in State of Amazonas, situated at 3 degrees south latitude in a tropical region; Araucária in State of São Paulo, situated at 25 degrees south latitude; and Santa Cruz River, Cardoso Island in State of Paraná, situated at 26 degrees south latitude, in the subtropical regions in Brazil. Another collection was made from Port Alegre, State of Rio Grande do Sul, situated at 30 degrees south latitude, in a temperate region in Brazil.

Judging from these facts, *B. macrosporum* is widely distributed from the tropical, via the subtropical, to the temperate regions in South America.

In the Western Pacific regions, such a wide distribution of the genus *Batrachospermum* from the tropical, via the subtropical, to the temperate regions has not been reported.

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熊野 茂\*・NECCHI, O. Jr.\*\* : 南アメリカの *Batrachospermum macrosporum* MONTAGNE

ブラジル パラナ州, サンパウロ州, アマゾナス州から採集された液浸標本を, バリの自然史博物館所蔵のタイプ標本と比較して, *Batrachospermum macrosporum* MONTAGNE と同定した。本種の器下細胞はロゼット状の側枝を付け, 造果器と器下細胞との間の原形質連絡は特に顕著である。これらの形質から, 本種は *B. hypogynum* と共に, アリスタータエ節以外の節に属させるのが良いと考える。(\*657 神戸市灘区六甲台町 神戸大学理学部生物学教室, \*\*Instituto de Biociências, Letras e Ciências Extras, Universidade Estadual Paulista, Caixa Postal 136, 15001, São José de Rio Preto, SP., Brasil)

