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Batrachospermum heteromorphum, sp. nov. (Rhodophyta) from Hubei Province, China.

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A new species of *Batrachospermum, B. heteromorphum*, is described from a mountain stream, Dabie Mountains, Hubei Province, China. This species is considered as a link species with the section *Batrachospermum* and the section *Aristatae*.

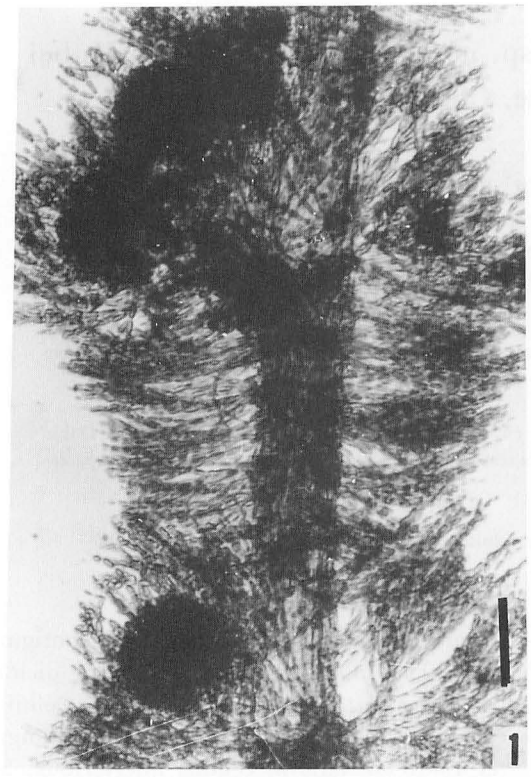
Key Index Words: Batrachospermum heteromorphum—*freshwater Rhodophyta*—*section* Batrachospermum—*section* Aristatae.

Jao (1941) reported eight genera, twenty one species and three varieties of the Chinese freshwater Rhodophyta, among which nine species and two varieties were new to science. Concerning the genus *Batrachospermum*, he reported eleven taxa including three new species. Based on the examination of the Jao's type specimens, Kumano (1984) stated that *B. sinense* seemed to resemble more closely taxa of the section *Batrachospermum* rather than taxa of the section *Turfosa* (as the section *Turficola*). In the present paper, a new species of *Batrachospermum, B. heteromorphum*, is described based on the specimen collected from Hubei in China. This new species is considered as a link one with the section *Batrachospermum* and the section *Aristatae*.

Description of the species

Batrachospermum heteromorphum Shi, Hu et Kumano sp. nov.

Frons monoica, caepitosa, 5-9 cm alta, mucosa, dense irregulariterque ramosissima. Cellulae axiales cylindricae, in medio leviter constrictae 400-800 μm longae, 100-200 μm latae; fila corticalia bene evoluta. Verticilli subglobosi et obconici vel pyriformes. Verticilli subglobosi, contigui, 900-1050 μm crassi; ramuli primarii dichotome ramosi, ad 11- — 16-cellulares; cellulis oblong-ovatis vel obovoideis, 30-55 μm longis et 10-16 μm latis in cellulis inferioribus, 5-10 μm longis et 2.5-5 μm latis in cellulis superioribus; ramuli secundarii non vel dichotome ramosi, sparsi, ad 4- — 10-cellulares; habitibus cellulosis cum cellulis ramulorum primariorum conguentes; cellulis 10-25 μm longis et 5-8 μm latis. Verticilli obconici vel pyriformes, plerumque contigui, 600-800 μm crassi; ramuli primarii, ad 12- — 16-cellulares; cellulis inferioribus cylindricis vel lanceolatis, 30-57 μm longis et 7-9 μm latis, cellulis superioribus lanceolatis vel obovoideis, 10-18 μm longis et 5-9 μm latis; ramuli secundarii numerosi, non vel dichotome ramosi, totum internodium confertim tegentes, ad 4- — 14-cellulares; habitibus cellulosis cum cellulis ramulorum primariorum conguentes; cellulis 10-25 μm longis et 3.5-5 μm latis. Pili pauci et breves, 10-40 μm longi. Spermatangia globosa vel subglobosa, 6-8 μm diametro, terminalis in ramulis primariis et secundariis. Ramuli carpogoniferi recti, e cellulis pericentralis ramulorum primariorum orientes, 48-120 μm longi, ex cellulis 5-12 cylindricis vel doliiformibus constantes. Carpogonium basi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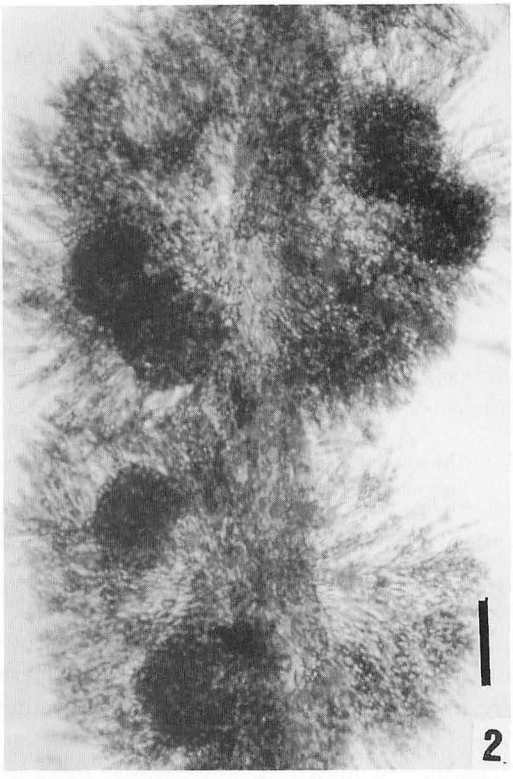
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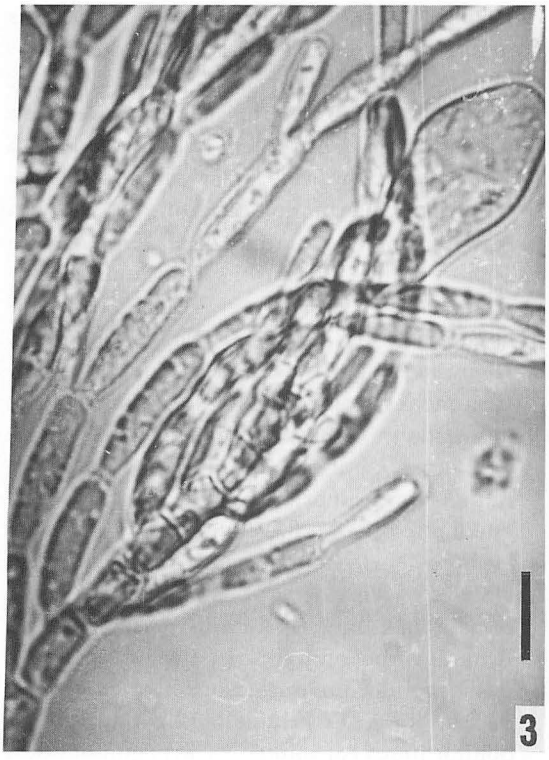
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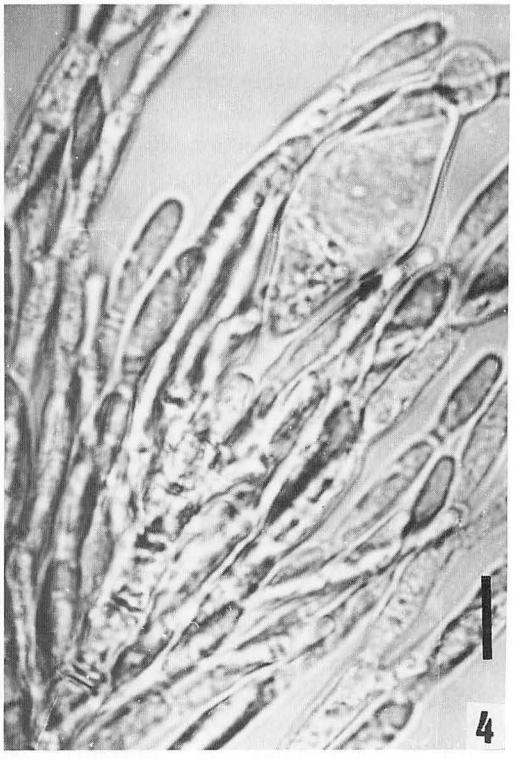
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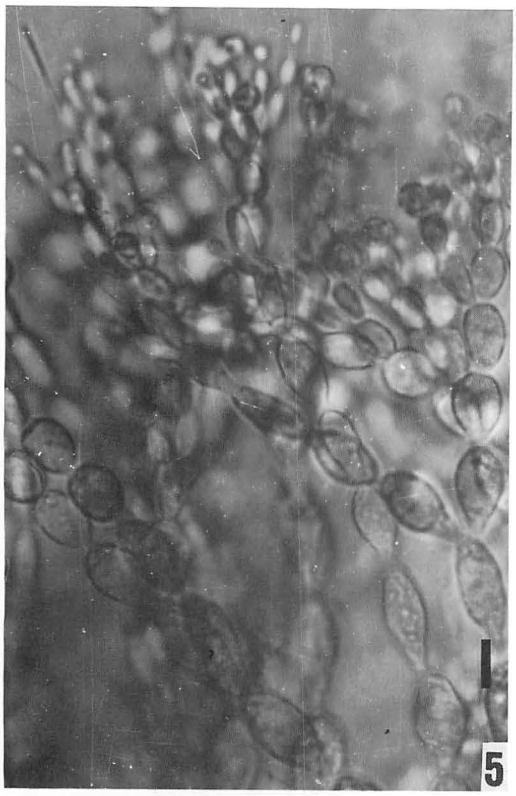
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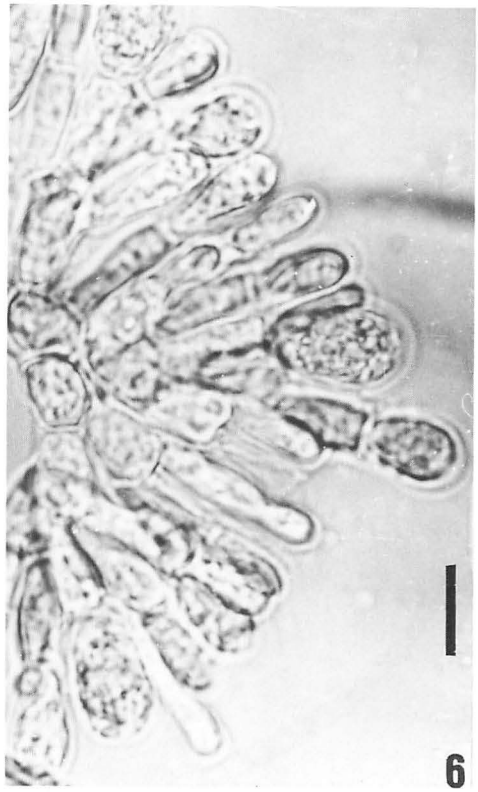
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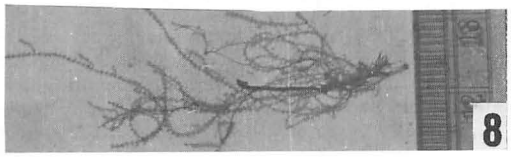
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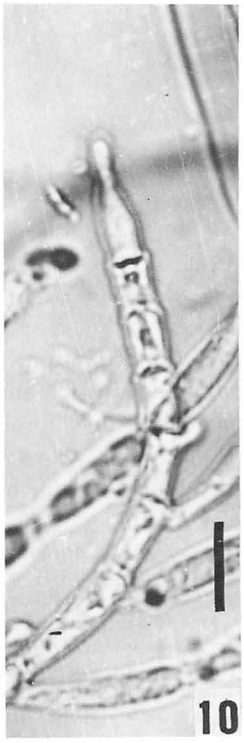
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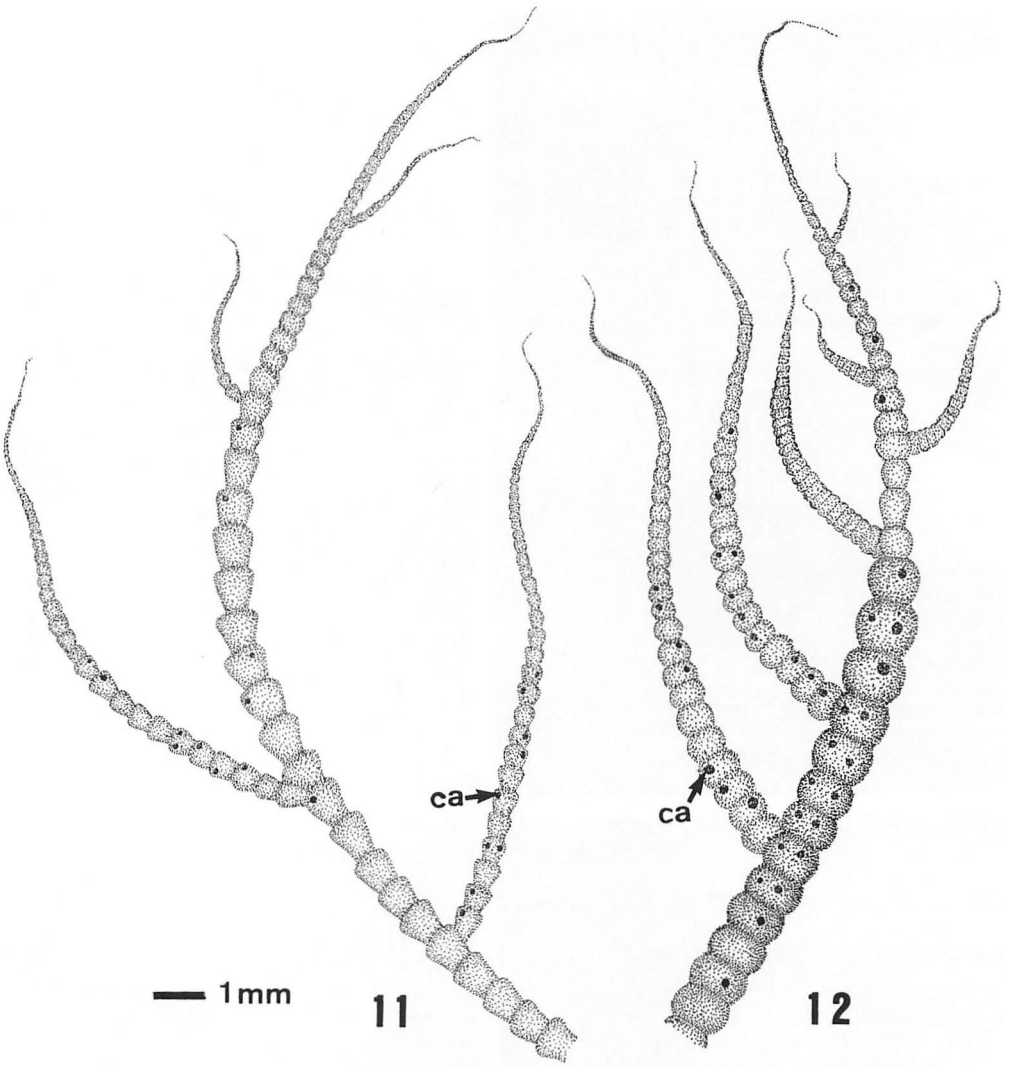
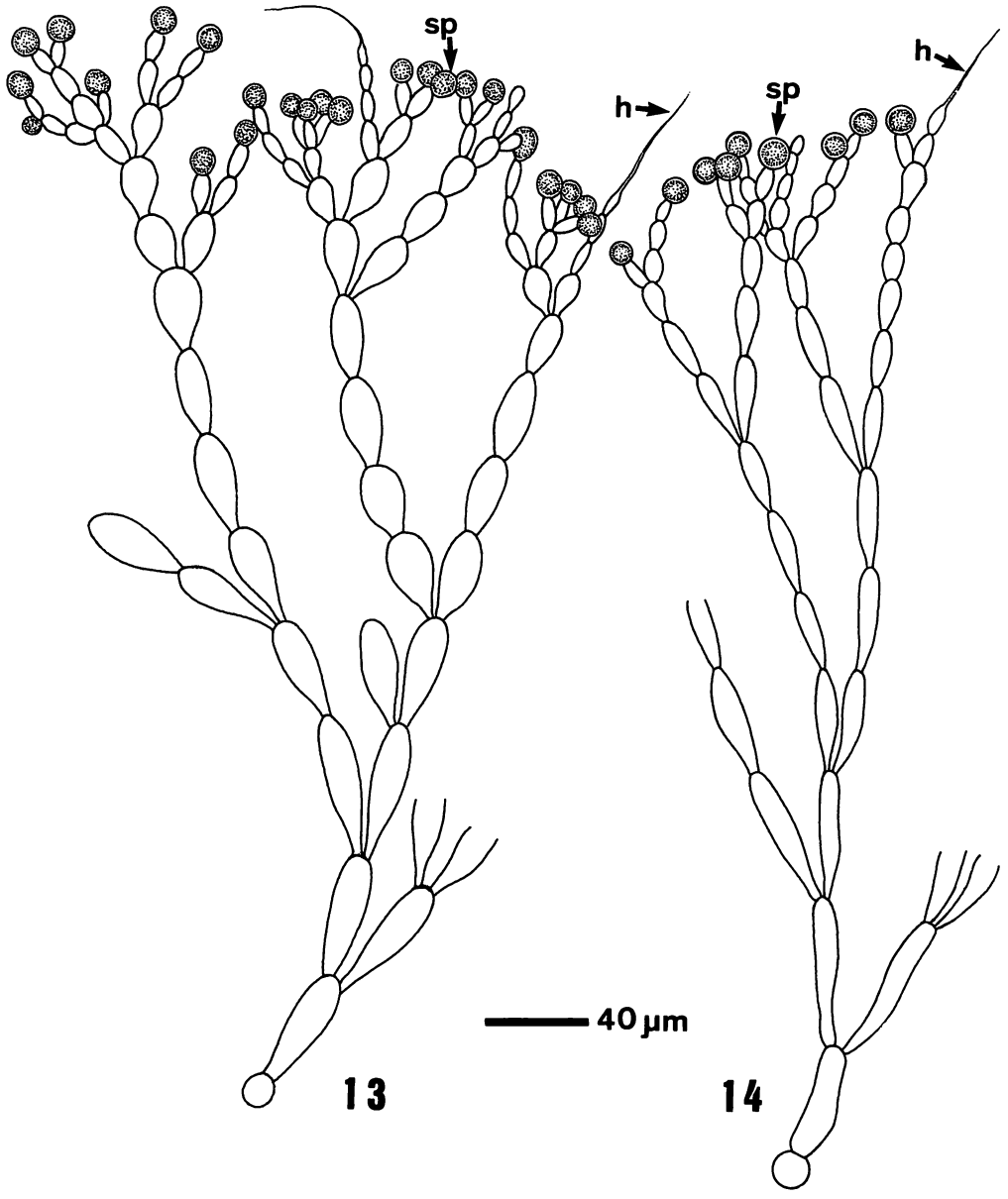


Figs. 11–12. *Batrachospermum heteromorphum* Shi, Hu et Kumano. 11. Obconic or pear-shaped whorls; 12. Subglobose whorls. (ca: carposporophyte). Scale bar: 1 mm.

circa 5–7.5 μm latum; trichogyne juvenior spathulata, vetustior angulose obovoidea vel obtrullata, parum ellipsoidea, 30–52 μm longa, 15–20 μm lata, breve pedicellata (4–8 μm longa), aliquot indistincte pedicellata. Carposporophytum singlum vel aliquot, globosum vel subglobosum, in centro verticilli insertum, 80–175 μm longum, 70–160 μm latum. Carposporangia obovata, 13–18 μm longa, 7–10 μm lata.

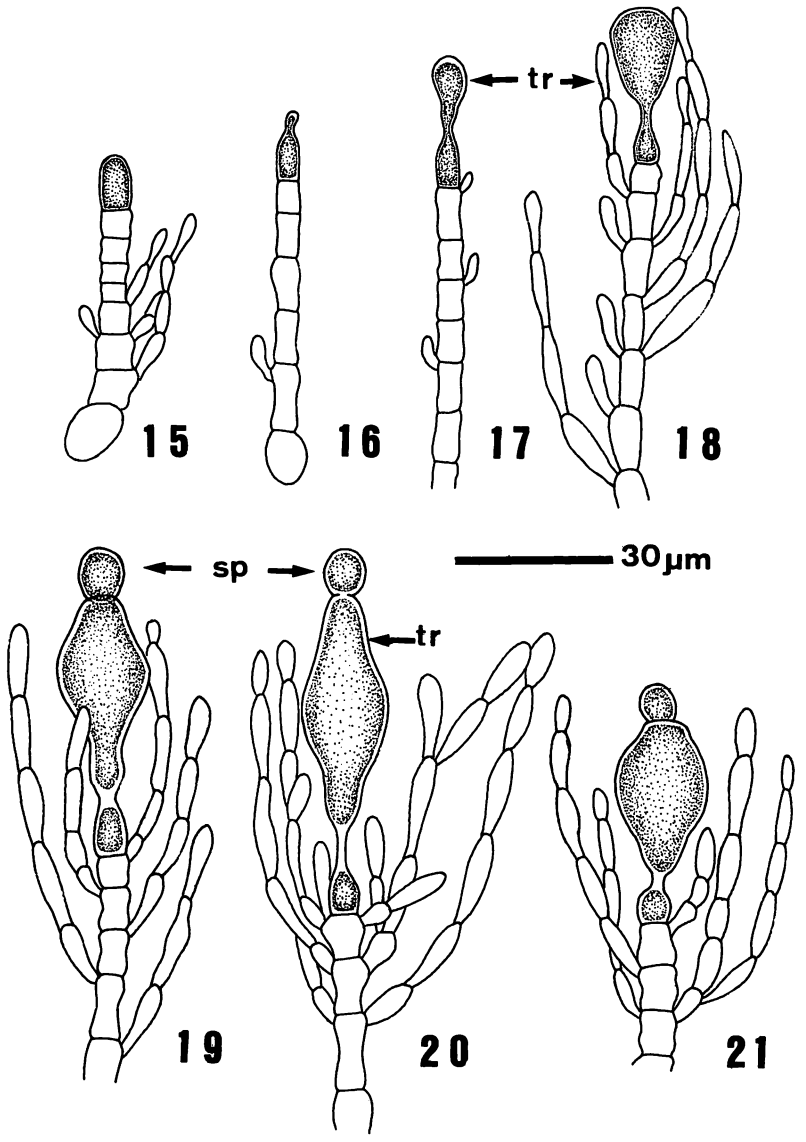
Figs. 1–4. *Batrachospermum heteromorphum* Shi, Hu et Kumano. 1. Obconic or pear-shaped whorls with one or several carposporophytes; 2. Subglobose whorls with several carposporophytes; 3. An unfertilized obtrullate carpogonium; 4. A fertilized angled obovate carpogonium. Scale bars: 10 μm.

Figs. 5–10. *Batrachospermum heteromorphum* Shi, Hu et Kumano. 5. Spermatangia terminal on primary branchlets of subglobose whorl; 6. Carposporangia terminal on gonimblast filaments; 7. Primary branchlets of obconic or pear-shaped whorls with a young spathulate carpogonium (left) and a mature fusiform carpogonium (right); 8. Frond; 9. A carpogonium with spathulate trichogyne in the early stage of the development; 10. A carpogonium with a rod-shaped initial of the trichogyne in the very early stage of the development. Scale bars: 10 μm.



Figs. 13–14. *Batrachospermum heteromorphum* Shi, Hu et Kumano. 13. Spermatangia terminal on primary branchlets of subglobose whorls; 14. Spermatangia terminal on primary branchlets of obconic or pear-shaped whorls. (sp: spermatangia, h: terminal hairs). Scale bar: 40 µm.

Fronds monoecious, caespitose, 5-9 cm high, mucilaginous, densely and irregularly branched (Fig. 8). Axial cells cylindrical, slightly concave at the middle, 400-800 µm long, 100-200 µm wide; cortical filaments well-developed (Figs. 1, 2). Whorls two types; subglobose whorl (Figs. 2, 12) and obconic or pear-shaped whorl (Figs. 1, 11). Subglobose whorl, closely touching each other, 900-1050 µm wide; primary branchlets dichotomously branched (Figs. 5, 13), consisting of 11-16 cell-stories; cells oblong-ovate or obovoid, 30-55 µm long and 10-16 µm wide in the lower cells, 5-10 µm long and 2.5-5 µm wide in the upper cells; secondary branchlets rare, unbranched or dichotomously branch-



Figs. 15–21. *Batrachospermum heteromorphum* Shi, Hu et Kumano. 15. A very young carpogonium-bearing branch with an initial of carpogonium; 16. Carpogonium with a rod-shaped initial of trichogyne in the very early stage of the development; 17–18; Young carpogonia with spathulate trichogynes in the early stage of the development; 19–20. Fertilized carpogonia with angled obovate or obtrullate trichgynes; 21. A fertilized carpogonium with ellipsoidal trichogyne. (tr: trichogyne, sp: spermatia). Scale bar: 30 μm.

ed, same shape as those of the primary branchlets, consisting of 4–10 cell-stories; cells 10–25 μm long and 5–8 μm wide. Obconic or pear-shaped whorl, usually touching each other, 600–800 μm wide; primary branchlets dichotomously branched (Figs. 7, 14), consisting of 12–16 cell-stories; the lower cells cylindrical or lanceolate, 30–57 μm long and 7–9 μm wide, the upper cells lanceolate or obovoid, 10–18 μm long and 5–9 μm wide; secondary branchlets numerous, unbranched or dichotomously branched, densely covering all the internodes, same shape as those of the primary branchlets, consisting of 4–14 cell-stories; cells 10–25 μm long and 3.5–5 μm wide. Terminal hairs rare and short, 10–40 μm

long. Spermatangia globose or subglobose (Figs. 5, 13, 14), 6-8 μm in diameter, aristing from the terminal cells of the primary and secondary branchlets. Carpogonium-bearing branch straight (Figs. 3, 4, 15-21), arising from the pericentral cells of the primary branchlets, 48-120 μm long, consisting of 5-12 cylindrical or barrel-shaped cells. Carpogonium about 5-7.5 μm wide at the base; young trichogyne spathulate (Figs. 9, 10, 17), old ones angled obovate or obtrullate (Figs. 3, 4, 19, 20), rarely ellipsoidal (Fig. 21), 30-52 μm long, 15-20 μm wide, obviously and shortly stalked (4-8 μm long), sometimes indistinctly stalked (Fig. 19). Carposporophytes single or several, globose or subglobose, inserted in the whorls center (Fig. 1, 2, 11, 12), 80-175 μm long, 70-160 μm wide. Carposporangia obovate (Fig. 6), 13-18 μm long, 7-10 μm wide.

Holotype: HP541, collected from a mountain stream Dabie Mountains, Hubei Province, China, on March 12, 1965, by Dr. Chen Jia-you *et al.*, and deposited in Freshwater Algae Herbarium, Institute of Hydrobiology, Academia Sinica (HBI), Wuhan, Hubei in People's Republic of China.

Isotype: HP541, collected from a Mountain stream, Dabie Mountains, Hubei Province, China on March 12, 1965, by Dr, Chen Jia-you *et al.*, and deposited in the Herbarium of Department of Biology, Faculty of Science, Kobe University, Rokko-dai, Nada-ku, Kobe, Japan.

Habitat: this species grows on rocks and stones in a mountain stream, Dabie Mountains, Hubei Province, China.

This new species closely resembles *B. gelatinosum* var. *obtrullatum* (as *B. moniliforme* var. *obtrullatum*, Kumano and M. Watanabe 1983) in having the obtrullate or angled obovate trichogyne (Figs. 3, 4, 19, 20) in mature, but differs from the latter in having the spathulate trichogyne (Figs. 9, 10, 17) in the early stage of the development and in having two types of whorls, viz., subglobose whorl (Figs. 2, 12) and obconic or pear-shaped whorl (Figs. 1, 11).

Discussion

Batrachospermum heteromorphum has two types of whorls, viz., subglobose whorl (Figs. 2, 12) and obconic or pear-shaped whorl (Figs. 1, 11). *B. gelatinosum* (as *B. moniliforme*, Roth 1800, Sirodot 1884, etc.) and *B. gelatinosum* var. *obtrullatum* (as *B. moniliforme* var. *obtrullatum*, Kumano and Watanabe 1983) of the section *Batrachospermum* has only the former type, the subglobose whorl. The later type, the obconic or pear-shaped whorl (Figs. 1, 11), of *B. heteromorphum* resembles that of *B. cayennense* of the section *Aristatae*.

The carpogonium-bearing branch of *B. heteromorphum* arises from the pericentral cells, consisting of 5-12 cylindrical or barrel-shaped cells, and has a few bract in the early stage of the development (Fig. 15). The differentiation of the carpogonium-bearing branch from the vegetative fascicles is remarkable. The terminal portion of the carpogonium sticks out, becomes a rod-shaped initial of the trichogyne (Figs. 10, 16), gives rise to a spathulate trichogyne (Figs. 7 left, 18), then turns into an obovoid, finally becomes into an angled obovate, an obtrullate (Figs. 3, 4, 19, 20) or an ellipsoidal trichogyne (Fig. 21) when it becomes mature.

The matured trichogynes of *B. gelatinosum* (as *B. moniliforme*, Kylin 1917, Kumano et al. 1970) are club- or urn-shaped and those of *B. gelatinosum* var. *obtrullatum* (as *B. moniliforme var. obtrullatum*, Kumano and Watanabe 1983) are angled obovate or obtrullate. During the process of the development, the initials of those carpogonia did not give rise to the spathulate trichogynes, but the obovate ones. The process of the early development of carpogonium of *B. heteromorphum* is similar to that of *B. beraense* and *B. cayennense* (Kumano and Ratnasabapathy 1982) of the section *Aristatae* and *B. cylindrocellulare* (Kumano 1978, 1984) of the section *Batrachospermum*.

From the above-mentioned facts, it is considered that this new species is assigned to the section *Batrachospermum* and seems to link with the section *Batrachospermum* and the section *Aristatae*.

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施　之新*・胡　征宇*・熊野　茂**：中国・湖北省産の淡水産紅藻カワモズク属の新種 *Batrachospermum heteromorphum*

中国・湖北省の山中の渓流から，淡水産紅藻カワモズク属の新種 *Batrachospermum heteromorphum* を記載した。本種の輪生技叢には球形と円錐形の2種類があり，成熟した受精毛は角ばった楕円形である。球形の輪生技叢，楕円形の受精毛などはカワモズク節によく認められる形質である。本種は円錐形の輪生技叢をも持ち，受精毛の発達の初期過程でスパチュラ形の受精毛が現れるなど，アリスタタエ節でよく認められるような形質をも併せ持っている。(*中華人民共和国・湖北省武漢430072　中国科学院・水生生物研究所藻類研究部門，**657 神戸市灘区六甲台　神戸大学理学部生物学教室)

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