

**Studies on freshwater red algae of Malaysia VII.
Batrachospermum tapirense sp. nov. from Sungai Tapir,
Johor, Peninsular Malaysia**

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Batrachospermum tapirense is described here as a new species from Sungai Tapir, Johor, Peninsular Malaysia. *Batrachospermum tapirense* resembles *B. bakarense* KUMANO et RATNASABAPATHY (1984) in having the short carpogonium-bearing branch consisting of 2-6 cells, and the carpogonium with club-shaped trichogyne more or less bent at the base. This species, however, differs from the latter in having the carpogonium-bearing branch, which arises descendantly from the rear side of the basal cell of the primary branchlet and grows toward the same direction that cortical filaments are formed, moreover, in having the radially branched and diffused gonimoblast filaments. Because of these characteristics, this species is described here as a new species of the genus *Batrachospermum*, and seems to be an intermediate form between the genus *Batrachospermum* and the genus *Sirodotia*.

Key Index Words: *Batrachospermum tapirense* sp. nov.; freshwater Rhodophyta; diffused gonimoblast filaments; radially branched gonimoblast filaments; taxonomy; West Malaysia.

The genus *Sirodotia* KYLIN (1912) is vegetatively similar to the genus *Batrachospermum* ROTH (1797), but differs reproductively in having diffused rather than radially branched gonimoblast filaments and an asymmetrical rather than an isodiametric carpogonium base (KYLIN 1912, ENTWISLE & KRAFT 1984). The present paper deals with a Malaysian species of the genus *Batrachospermum*, which seems to be an intermediate form between the genus *Batrachospermum* and the genus *Sirodotia*.

Specimen Examined

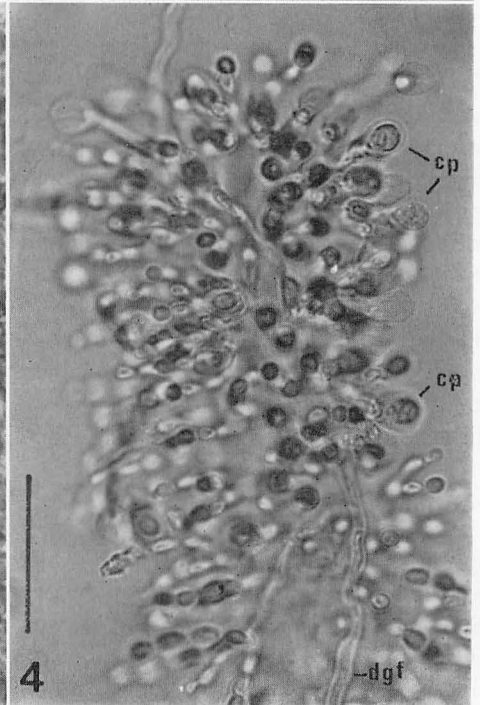
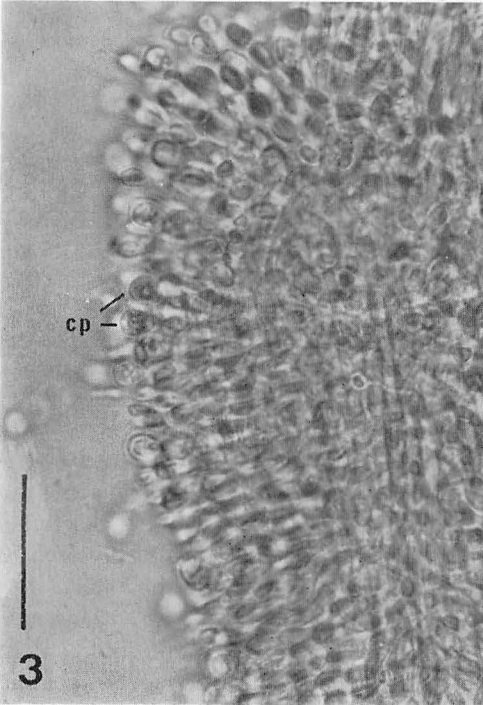
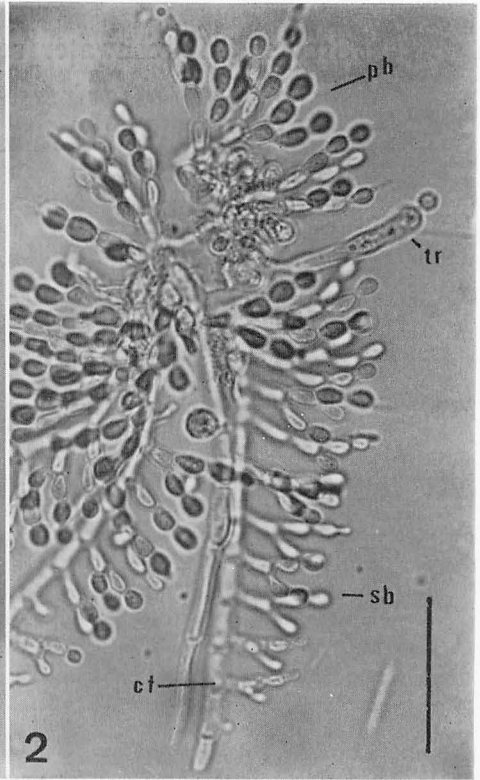
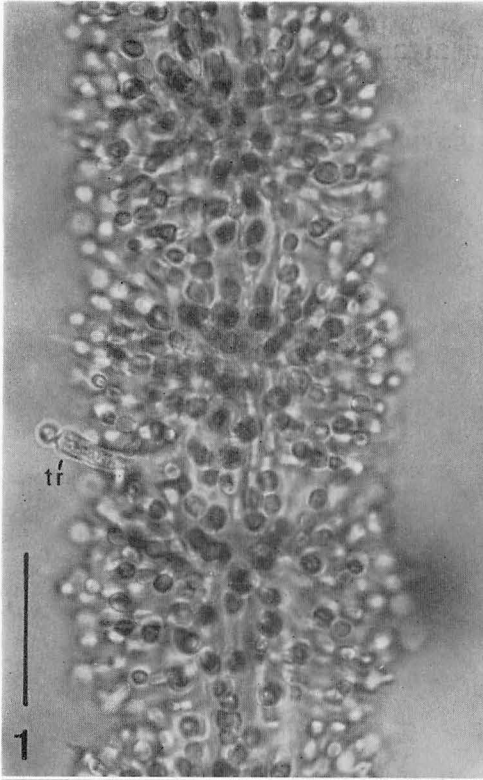
Specimens examined in this study were collected from Sungai Tapir, a tributary of Sungai Endau, by PHANG Siew Moi on September 30, 1985. At the time of collecting the specimens, the water was about 10 cm deep, the temperature 24.7°C, pH 6.2, dissolved oxygen 6.47 mg/l, conductivity

20.0 μ mho/cm, total alkalinity 3.6 mg CaCO₃/l, and NO₃-N 68.0 μ g/l. The specimens examined (No. 216) were deposited in the Herbarium of Faculty of Science, Kobe University and the Herbarium of Department of Botany, University of Malaya.

Description of Species and Discussions

Batrachospermum tapirense KUMANO et PHANG sp. nov. (Figs. 1-17)

Frons monoica, ca. 6 cm alta, 80-170 μ m crassa, plus minusve dichotome ramosa, modice mucosa, aeruginosa. Cellulae axiales cylindricae, 20-80 μ m crassae, 70-300 μ m longae. Verticilli obconici, in parte vetustiore frondis contigui et plus minusve compressi. Ramuli primarii dichotome vel trichotome ramificantes, ex 4-5 cellulis constantes; cellulae fasciculorum fusiformes vel ellipsoideae, 3-5 μ m crassae, 4-11 μ m longae



(Fig. 10); pili praesentes. Fila corticales bene evoluta (Fig. 10, 15). Ramuli secundarii ex 2–4 cellulis constantes, numerosi, totum internodium obtegentes; cellulae fasciculorum fusiformes vel ellipsoideae (Fig. 1, 2, 10, 15). Spermatangia globosa, 4–6 μ m diametro, in ramulis primariis et secundariis terminalia (Fig. 5). Rmuli carpogoniferi e cellulis pericentrali (cellulis basi ramulorum) descendens orientes, ex cellulis 4–6 disc- vel dolliformibus constantes; carpogonium basi 4–5 μ m crassum, apice 5–6 μ m crassum, 30–40 μ m longum; trichogyne claviformis, plus minusve indistincte pedicellata, ad basim saepe flexa (Fig. 8–13). Bracteae breves, Carposporophytum indefinitum, verticillum aequans; fila gonimoblastorum radiale ramificantes (Fig. 14), diffusa, et circum nodium et instrato corticali reptantia (Fig. 14, 16, 17). Carposporangia globosa vel ellipsoidea, 5–8 μ m crassa, 8–12 μ m longa (Fig. 14, 17).

Frond monoecious, ca. 6 cm high, 80–170 μ m wide, more or less dichotomously branched, moderately mucilaginous, green with a bluish tinge. Axial cells cylindrical, 20–80 μ m wide, 70–300 μ m long. Whorls obconical, continuous and more or less compressed in the aged fronds. Primary branchlets dichotomously or trichotomously branched, consisting of 4–5 cell-stories; cells of fascicles fusiform or ellipsoidal, 3–5 μ m wide, 4–11 μ m long (Fig. 10); hairs present. Cortical filaments well-developed (Figs. 10, 15). Secondary branchlets consisting of 2–4 cell-stories, numerous, covering all the internodes (Figs. 1, 2, 10, 15). Spermatangia globose, 4–6 μ m in diameter, terminal on primary and secondary branchlets (Fig. 5). Carpogonium-bearing branch arising descendantly from the pericentral cell (the basal cell of the primary branchlet), con-

sisting of 4–6 disc- or barrel-shaped cells; carpogonium 4–5 μ m wide at the base, 5–6 μ m wide at the apex, 30–40 μ m long; trichogyne club-shaped, more or less indistinctly stalked, often bent at the base (Figs. 8–13). Bracts very short, more or less laterally issued. Carposporophyte indefinite and indistinguishable from the whorl and equalling in length; gonimoblast filaments radially branched (Fig. 14), diffused and creeping along the cortical filaments (Figs. 14, 15, 17). Carposporangia globose or ellipsoidal, 5–8 μ m wide, 8–12 μ m long (Figs. 14, 17).

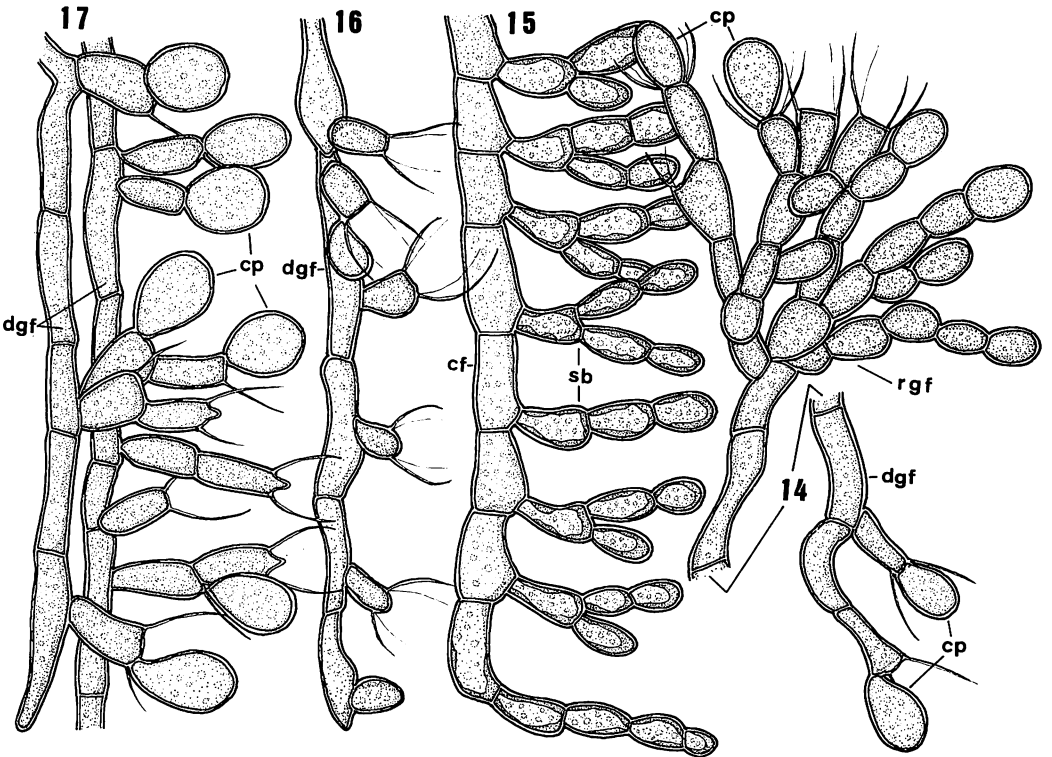
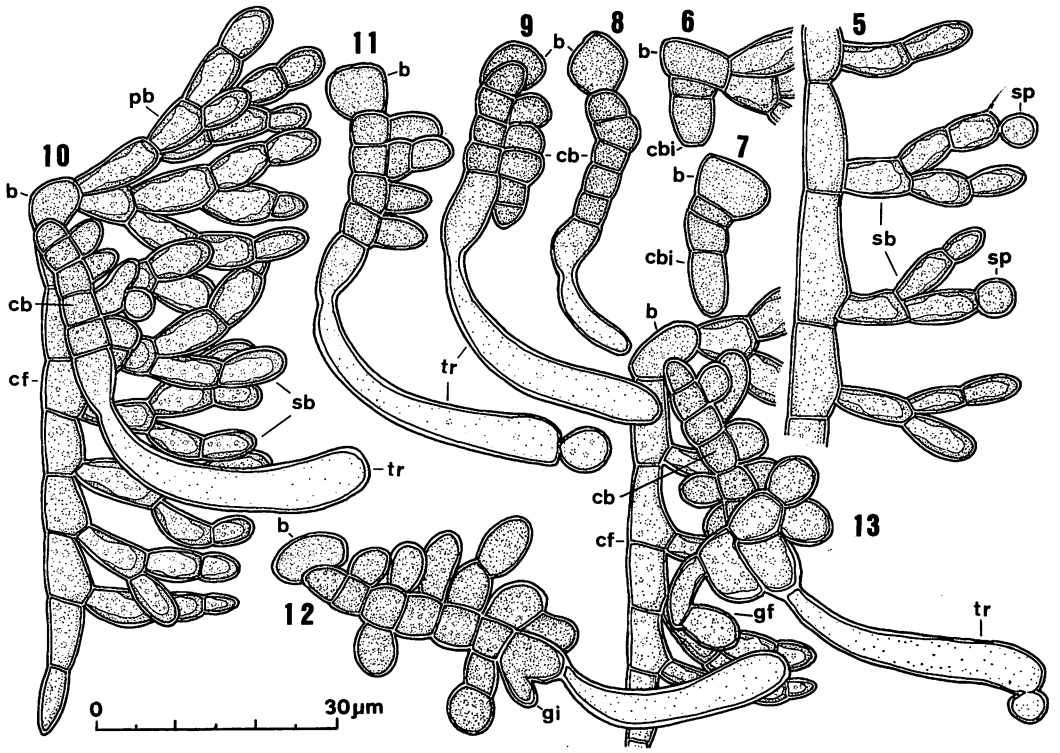
Holotype: PHANG Siew Moi (No. 216), 30/IX, 1985, Herbarium of Faculty of Science, Kobe University. Isotype: Herbarium of Department of Botany, University of Malaya.

Type locality: Sungei Tapir, a tributary of Sungei Endau, Johor, Malaysia.

Distribution; Known from the type locality only.

The initial of the carpogonium-bearing branch of *B. tapirens* is produced from the rear side of the pericentral cell (the basal cell of the primary branchlets), which is in the same side where the initial of the cortical filament is formed (Figs. 6, 7). Usually, a carpogonium-bearing branch is produced at each whorl and grows toward the similar direction that cortical filaments descendantly eongate (Fig. 10, cb). The terminal portion of the carpogonium sticks out and finally gives rise to a club-shaped and slightly curved trichogyne indistinctly stalked and often bent or curved at the base (Figs. 8–11, tr). In hitherto known species of the genus *Batrachospermum* such as *B. cayennense* MONTAGNE (1850), *B. virgatum* (KUTZING) SIRODOT (1884), *B. bakarensis* KUMANO et RATNASABAPATHY

Figs. 1–4. *Batrachospermum tapirens* KUMANO et PHANG 1. Structure of thallus, note the extruding terminal portion of trichogyne; 2. A part of thallus showing primary branchlets, a carpogonium-bearing branch, cortical filaments and secondary branchlets; 3. Carposporophyte is indistinguishable from the whorl; 4. Radially branched and diffused gonimoblast filaments. (cp, carposporangium; cf, cortical filament; dgf, diffused gonimoblast filament; pb, primary branchlets; sb, secondary branchlets; tr, trichogyne, Scale bar: 40 μ m for Figs. 1–4)



(1984), *B. vagum* var. *periplocum* SKUJA (1969) and *B. orthostichum* SKUJA (1931), the carpogonium-bearing branch usually arises ascendantly from the pericentral cell (the basal cell). On the other hand, *B. tapirensis* resembles *B. bakarensis* KUMANO et RATNASABAPATHY (1984) in having a relatively short carpogonium-bearing branch and a club-shaped trichogyne, so that it might be assigned to the section *Viridia*. However, *B. tapirensis* differs from *B. bakarensis* and also from the rest of the species of the genus *Batrachospermum* in having the carpogonium-bearing branch, which arises from the rear side of the pericentral cell (the basal cell of the primary branchlets) and grows descendantly in the same way as the cortical filaments elongate (Figs. 10, 13, cb). As a result of the above-mentioned development, the terminal portion of trichogyne faces outward of the whorl and extrudes at the internode of the whorl (Fig. 1, tr).

After fertilization (Fig. 11) the basal portion of the carpogonium extends and forms the initial of the gonimoblast filament (Fig. 12, gi), and farther gonimoblast filaments (Fig. 13, gf). The carposporophyte grows out into radially branched (Fig. 14, rgf) and diffused gonimoblast filaments (Fig. 14, dgf), which are extended along the cortical filaments (Fig. 16, 17, dgf). The carposporangia are produced terminally or subterminally on the short laterals of the diffused gonimoblast filaments (Fig. 16, 17, cp).

The genus *Sirodotia* was established and separated from the genus *Batrachospermum* on the characteristics of carposporophyte and carpogonium (KYLIN 1912). The car-

posporophyte of the genus *Sirodotia* consists of diffused filaments that extend along the cortical filaments, and the carpogonium has a distinct protuberance on one side of the base.

Batrachospermum tapirensis is described as a new species and assigned to the genus *Batrachospermum* because of its essentially symmetrical carpogonium. On the other hand, *B. orthostichum* SKUJA (1931) was also assigned to the genus *Batrachospermum* because of its symmetrical trichogyne and essentially globular carposporophyte although SKUJA observed some diffused filaments extending out from a globular carposporophyte of *B. orthostichum* SKUJA (1931) and *B. vagum* var. *periplocum* SKUJA (1969). KUMANO et al. (1970) also observed some diffused gonimoblast filaments extending out from a globular carposporophyte of *B. vagum*.

The gonimoblast of *B. tapirensis* is indistinguishable from the whorl to which the length is equal (Fig. 3). Moreover, two types of gonimoblast filaments are observed: one is radially branched (Fig. 14, rgf), and is usually found in the genus *Batrachospermum*; the other is diffused (Figs. 4, 14, 16, 17, dgf), and is typically found in the genus *Sirodotia* and rarely in a few species of the genus *Batrachospermum* such as *B. orthostichum* and *B. vagum*. Because of these characteristics, the above-mentioned taxa of the genus *Batrachospermum* and *B. tapirensis* seem to be apparently intermediate forms linking the genus *Batrachospermum* and the genus *Sirodotia*. *B. orthostichum*, *B. vagum*, *B. vagum* var. *periplocum* and *B. tapirensis* might be assigned to the section *Turficola* or a separate new section.

Figs. 5-17. *Batrachospermum tapirensis* KUMANO et PHANG 5, Spermatangium terminal on the secondary branchlets; 6-9, Early stages of development of carpogonium-bearing branch; 10, A part of thallus showing primary branchlet, cortical filament, secondary branchlets and carpogonium-bearing branch, which grows toward the same direction that cortical filament elongates; 11, A carpogonium-bearing branch with a fertilized trichogyne; 12, 13, Early stages of development of carposporophyte; 14, Radially branched gonimoblast filaments and diffused one; 15, Cortical filament and secondary branchlets; 16-17, Carposporangia terminal on the laterals of diffused gonimoblast filaments, (b, basal cell of primary branchlet; cb, carpogonium-bearing branch; cbi, initial of carpogonium-bearing branch; cf, cortical filament; cp, carposporangium; dgf, diffused gonimoblast filament; gf, gonimoblast filament; gi, initial of gonimoblast filament; rgf, radially branched gonimoblast filament; sb, secondary branchlet; sp, spermatangium)

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熊野 茂*・PHANG Siew Moi** : マレーシアの淡水産紅藻 VII. 半島マレーシア,
 ジョホール州, タピア川の *Batrachospermum tapirensis*, sp. nov.

ジョホール州, エンドウ川の支流, タピア川からカワモヅク属の1新種 *Batrachospermum tapirensis* が記載された。既知のカワモヅク属の他の種と違って、本種の造果器をつける枝は、皮層糸が伸長するのと同じ方向、即ち下方に発出する。また、放射状に分枝する造胞糸と皮層糸に沿って伸長する造胞糸との、2種類の造胞糸をもつことから、本種とユタカカワモヅク属との密接な関連が考えられる。(*657 神戸市灘区六甲台 神戸大学理学部生物学教室, **Institute of Advanced Studies, University of Malaya)