

## Taiju Kitayama and Tadao Yoshida: First report of *Phaeophila dendroides* (P. Crouan et H. Crouan) Batters (Ulvophyceae, Chlorophyta) from Japan

*Key Index Words:* Chlorophyta—distribution—endophyte—epiphyte—*Phaeophila dendroides*—*Phaeophilaceae*—*Phaeophilales*—*Ulvophyceae*.

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A microscopic alga referable to *Phaeophila dendroides* (P. Crouan et H. Crouan) Batters (Phaeophilaceae, Phaeophilales, Ulvophyceae) was collected as endophytes in *Hyalosiphonia caespitosa* Okamura at Sai, Aomori Pref. on 17 May 1988 (coll. T. Kitayama) and as epiphytes on *Halopteris filicina* (Grateloup) Kützinger at Kasumi, Hyogo Pref. on 2 August 1990 (coll. S. Enomoto). The thalli of *P. dendroides* are green in color and composed of branched uniseriate filaments (Fig. 1). Those cells are cylindrical or irregular in shape, 35–110  $\mu\text{m}$  in length and 13–45  $\mu\text{m}$  in diameter. Each cell contains a parietal chloroplast with many pyrenoids. Setae (3–9  $\mu\text{m}$  in diameter) are twisted. The morphology of vegetative thalli agrees well with the previous reports of the species (O'Kelly and Yarish 1980, Correa *et al.* 1988).

*Phaeophila dendroides* is a cosmopolitan species, but this is the first report from the western coast of the Pacific Ocean. Although this species has a chaetophoraceous appearance, it is more closely related to the Ulvaceae (Ulvales, Ulvophyceae) in the structure of its characteristically twisted setae etc., according to O'Kelly and Floyd (1984). Recently Chappell *et al.* (1990) proposed the new order Phaeophilales and family Phaeophilaceae because of its unique flagellar apparatus provided with six microtubular rootlets and single-lobed terminal caps, and unique zoosporangia whose mother cells became multinucleate in the early developmental stage (O'Kelly and Yarish 1980). At present only a single species is recognized in

the order.

In order to observe reproductive cells, unialgal cultures were established from the vegetative cells of the thalli collected at Kasumi, using Provasoli's ES medium (Provasoli 1968). Culture conditions used

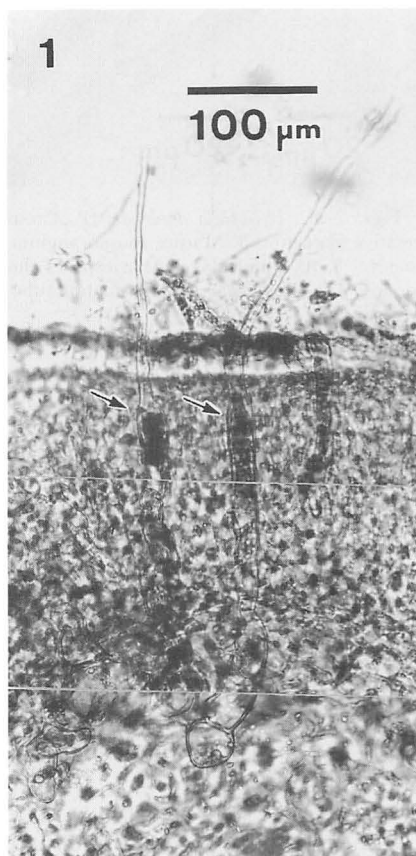
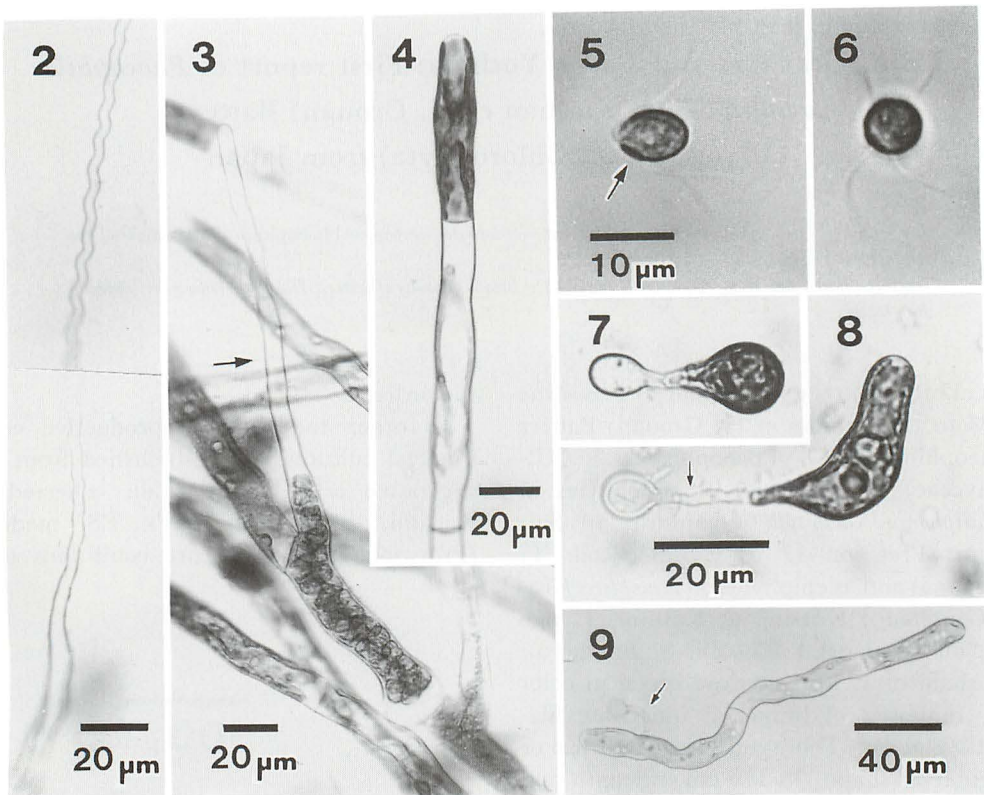


Fig. 1. *Phaeophila dendroides* (P. Crouan et H. Crouan) Batters from nature (arrows), endophytic in *Hyalosiphonia caespitosa* Okamura.



Figs. 2-9. *Phacophila dendroides* (P. Crouan et H. Crouan) Batters in culture at 20°C. 2. Seta on the vegetative filament. 3. Mature zoosporangium with a long exit tube (arrow). 4. Terminal portion of vegetative filament. 5, 6. Quadriflagellate zoospores showing a stigma (arrow). 7-9. Various stages of germination of zoospores with a long, narrow germination tube (arrows). Scales in Fig. 5 and Fig. 8 apply also to Fig. 6 and Fig. 7 respectively.

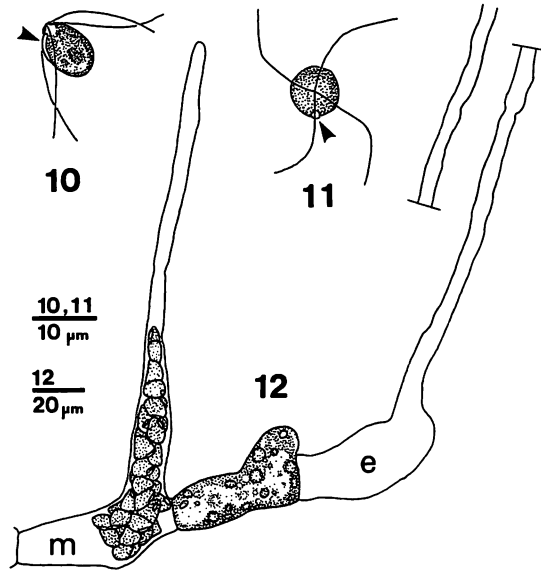
were 5°C, 10°C, 15°C and 20°C, under white fluorescent light of about  $30 \mu\text{Mm}^{-2}\text{s}^{-1}$  (10°C) or  $50 \mu\text{Mm}^{-2}\text{s}^{-1}$  (5°C, 15°C and 20°C), L : D = 16 : 8 h, photoregime.

The initial filaments grew well at 10°C, 15°C and especially 20°C, however, they did not elongate at 5°C. Vegetative cells in culture were narrow cylindrical, rather straight, 10-27 μm in diameter and 44-200 μm in length, containing a parietal chloroplast with 6-24 pyrenoids. The chloroplasts in the terminal cells are relatively large (Fig. 4). The cells often had a twisted seta (3-5 μm in diameter) (Fig. 2). Each vegetative cell could form a thick protuberance and then it transformed into zoosporangium at 10°C, 15°C and 20°C (Figs. 3, 12). The sporangia were cylindrical, straight or often bent, 15-30 μm

in diameter, having a long exit tube. They contained 22-58 zoospores. The zoospores (5-7 μm × 9-12 μm) possessed four flagella and a chloroplast with a prominent stigma (Figs. 5, 6, 10, 11). They were released through the exit tube and swam showing positive phototaxis. After the attachment to the substratum, the spore became rounded and then extended a narrow germination tube giving rise to a new vegetative filament (Figs. 7, 8, 9). Our culture results agreed well with those of the previous reports (O'Kelly and Yarish 1980, Correa *et al.* 1988).

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Figs. 10–12. *Phaeophila dendroides* (P. Crouan et H. Crouan) Batters in culture at 20°C. 10, 11. Quadriflagellate zoospores showing a stigma (arrowheads). 12. Mature zoosporangium (m) and empty zoosporangium (e).

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北山太樹・吉田忠生：日本新産緑藻 *Phaeophila dendroides* (P. Crouan et H. Crouan) Batters

青森県佐井で採取された紅藻イソウメドキ *Hyalosiphonia caespitosa* Okamura に内生していた緑藻と兵庫県香住において採取されたカシラザキ *Halopteris filicina* (Grateloup) Kützinger に着生していた緑藻を *Phaeophila dendroides* (P. Crouan et H. Crouan) Batters (Phaeophilaceae, Phaeophilales, Ulvophyceae) と同定した。本種は世界的に分布が知られているが、太平洋西岸からの報告はこれが初めてである。藻体は主に円柱状の細胞からなる単列糸状体で、大部分の細胞から振れた剛毛が出ている。各細胞は一個の側壁性の葉緑体を含み、これには多数のピレノイドが見られる。生殖細胞を観察するため、香住の株から得られた栄養細胞を 5-20°C の長日条件で培養した結果、10°C, 15°C, 20°C で成長、成熟して、長い放出管を持った孢子嚢を形成し、4 鞭毛の遊走子が放出された。遊走子は基物に付着後、間接糸状型の発芽をして、母藻と同様の糸状体に発生した。(060 札幌市北区北10条西 8 丁目 北海道大学理学部植物学教室)