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Sexual reproductive organs of *Udotea orientalis* (Bryopsidales, Ulvophyceae) from Japan

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Abstract Sexual reproductive organs of *Udotea orientalis* A. Gepp & E. Gepp were observed for the first time. The presumed gametangia are long cylindrical, 1.2–3.2 mm in length, 100–230 μm in diameter. The blade siphons have asymmetrical constrictions above the dichotomous division, which are similar to the ones on the erect filaments of *Chlorodesmis fastigiata* (C. Agardh) Ducker.
Key words: gametangia, *Udotea orientalis*, Udoteaceae, Ulvophyceae.

The genus *Udotea* Lamouroux can be distinguished from the other genera of the Udoteaceae (Bryopsidales), such as *Avrainvillea* Decaisne, Boodleopsis A. Gepp & E. Gepp, *Chlorodesmis* Harvey & Bailey, *Halimeda* Lamouroux, *Rhipilia* Kützing, *Tydemania* Weber-van Bosse, by calcified erect thalli with three parts: 1) an uncalcified, basal, rhizoidal mass; 2) an upright corticated stipe; and 3) a funnel- or fan-shaped terminal blade (Littler & Littler, 1990). According to the recent study about the ribosomal DNA phylogeny of Udoteaceae by Kooistra (2002), however, the genera *Udotea* is not monophyletic and lumped with *Chlorodesmis* and *Penicillus*.

Udotea orientalis was described by A. Gepp & E. Gepp (1911) based on the sterile materials collected from Indonesia. Many investigators recorded this alga from the Indian Ocean (Silva *et al.*, 1996), the East China Sea and Oceania (Yoshida, 1998). However, there is no observations of gametangia of *U. orientalis* so far because this alga tends to propagate by only vegetative reproduction in nature.

Materials and Methods

Vegetative plants of *Udotea orientalis* were collected from the seacoast of Kushi, Nago, Okinawa Pref., Japan (26°30′31″N, 128°00′45″E) on 3 March 2002 by the author. The plants collected were transplanted to sand bed in a water tank filled with seawater. The temperature of the water was maintained at 25°C. Four months later, thallus of a mature plant was preserved in a solution of 5% Formalin-seawater. Anatomical observations were made on a mature plant by microscope.

Results

Mature plant (4.5 cm in height) of *Udotea orientalis* became white in colour and formed many sporangia on its outer margin of the blade (Fig. 1). The sporangia were terminal on the balde siphons, long cylindrical, often curved, 1.2–3.2 mm in length, 100–230 μm in diameter (Fig. 2A–E). I could not observe release of spores from the reproductive organs.

The blade siphons of the plant are smooth, 16–42 μm in diameter, having asymmetrical constrictions above each dichotomous division (Fig. 2F).

Discussion

The sporangia formed on the balde of *Udotea orientalis* A. Gepp & E. Gepp are considered to be gametangia on the analogy of the other alga of

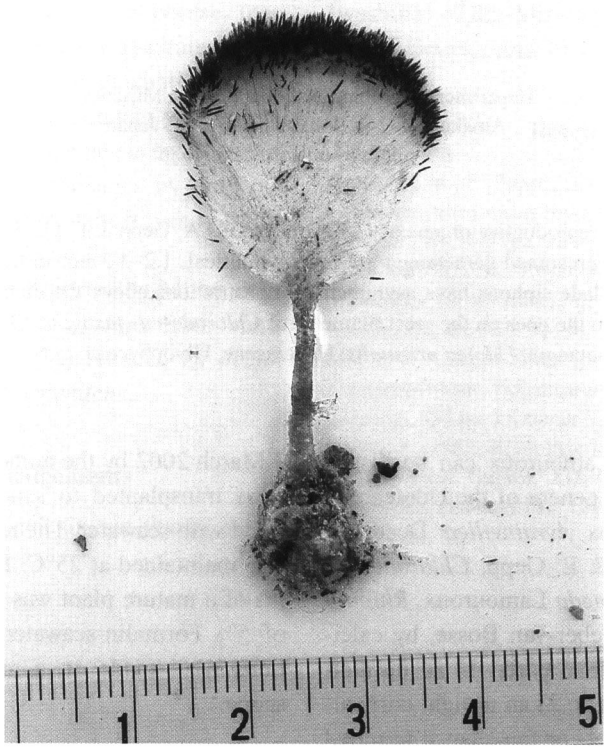

Fig. 1. *Udotea orientalis* A. Gepp & E. Gepp. Mature plant with presumed gametangia on the blade.

the Udoteaceae. For example, Meneisz (1980) observed sexual reproduction of *Udotea petiolata* (Turra) Børgesen, which has a life cycle by only macroscopic gametophytes forming female and male gametangia. However, this non-calcareous species was restored to the genus *Flabellia* by Nizamuddin (1987), and so reproductive information about *Udotea* remains scanty (Littler & Littler, 1990). In their monograph of *Udotea* from the western Atlantic with 21 taxa, Littler & Littler (1990) observed terminal reproductive siphons on only two species, *U. caribaea* Littler & Littler and *U. cyathiformis* Decaisne. In *Udotea* species the sexual reproduction is considered to be rare because they have ability to propagate with stolons.

The blade siphons have asymmetrical constrictions above the dichotomies, which are similar to the ones on the erect filament siphons of *Chlorodesmis fastigiata* (C. Agardh) Ducker. On the other hand, *Chlorodesmis caespitosa* J. Agardh and several species of *Udotea* (*e.g. U. abbottiorum* Littler & Littler, *U. looensis* Littler & Littler, *U. cyathiformis* Decaisne) have symmetrical constrictions above the dichotomies of the blade siphons (Littler & Littler, 1990). The ribosomal DNA phylogeny of Udoteaceae by Kooistra (2002) showed that *Udotea orientalis* is closer to *Chlorodesmis fastigiata* than the other species of *Udotea*. This character supports well the Kooistra's phylogeny.

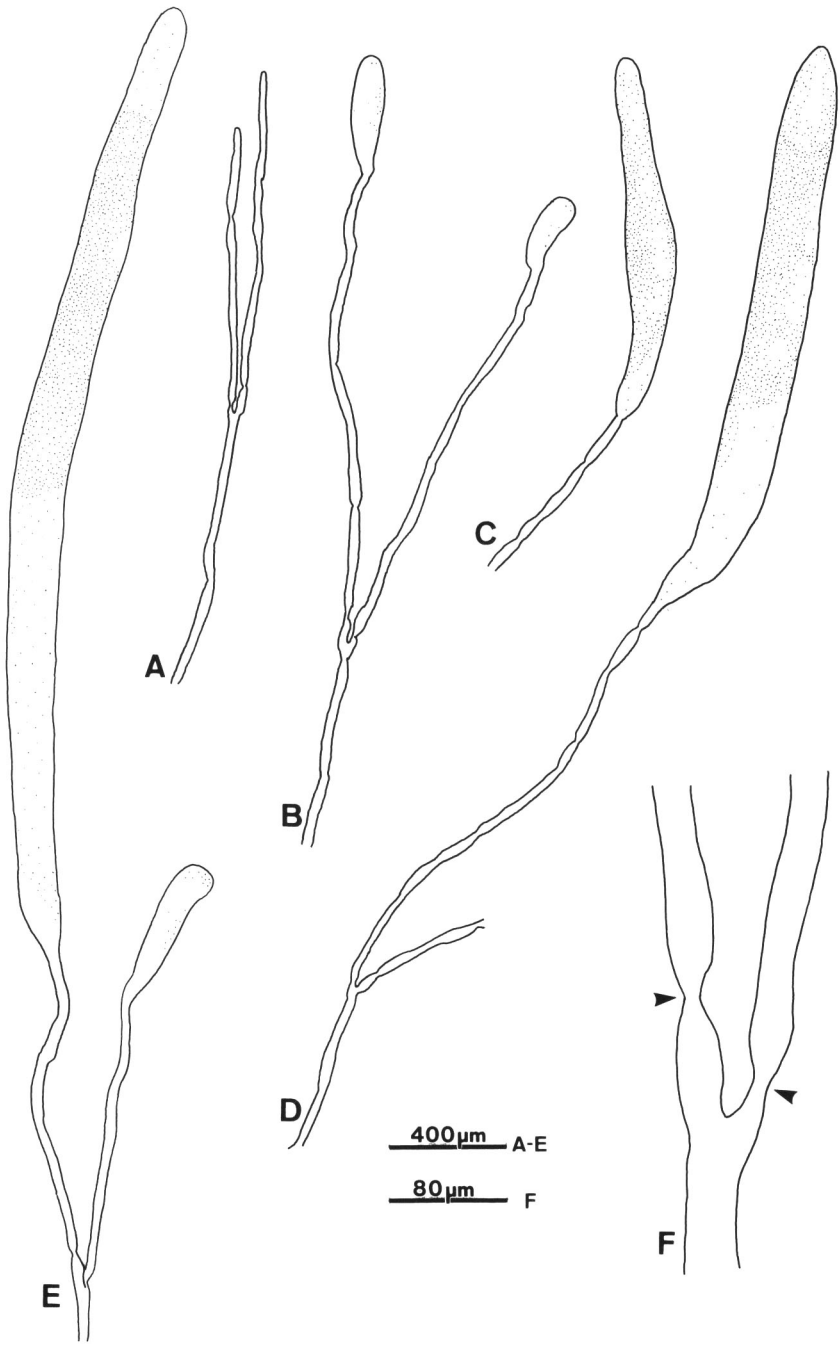

Fig. 2. *Udotea orientalis* A. Gepp & E. Gepp. A–E. Presumed gametangia in the various stages. F. Dichotomy of the blade siphons showing two asymmetrical constrictions (arrowheads).

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Errata

Minoru Nakanishi, Hiroyuki Kashiwadani and Kwang Hee Moon (2003). Taxonomical Notes on Japanese Graphidaceae (Ascomycotina), including some new combinations. Bull. Natn. Sci. Mus., Tokyo, Ser. B, 29(2): 83–90.

page	line	for	read
83.	16.	*soozana*	*soozanum*
83.	23.	*yakushimensis*	*yakushimense*
83.	26.	*hypoleptym*	*hypoleptum*
84.	13.	*yakushimensis*	*yakushimense*
85.	23.	*soozana*	*soozanum*
86.	43.	*fujisanensis*	*inabensis*
86.	45.	*soozana*	*soozanum*
88.	2.	*exultatum*	*exaltatum*
88.	15.	*yakushimensis*	*yakushimense*
88.	26.	*endofusca*	*endofuscum*
89.	17.	*intortula*	*intortulum*