

Conjugation and zygospores of a filamentous green alga, *Spirogyra* sp., propagated in a littoral zone of the north basin of Lake Biwa, Japan

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Abstract

Photographs of conjugation and zygospores of a filamentous green alga, *Spirogyra* sp., propagated in a littoral zone of the north basin of Lake Biwa were obtained for the first time in this report. Sample containing conjugation and zygospores was collected at Mizugahama (Oumi-Hachiman City of Shiga Prefecture) located in the eastern coast of the north basin of Lake Biwa on 23 June 2005. Conjugation formed by two different filaments was scalariform type. Fertile cells inflated both sides. Zygospores were ellipse-shaped. Since the collected zygospores did not fully ripen, the exact species remains unknown.

Key words: Conjugation, Filamentous green algae, Lake Biwa, *Spirogyra* sp., Zygospore

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Introduction

Genus *Spirogyra* is a common group of filamentous green algae observed in many freshwater environments. Propagation of *Spirogyra* sp. in littoral zones of the north basin of Lake Biwa has been reported by Nozaki (1999), Nozaki (2001), Nozaki and Mitamura (2002), Nozaki et al. (2003) and Ishida et al. (2006). The development of the *Spirogyra* sp. community seems to be the result of an increase in the nutrient supply from human activities (Nozaki, 2004).

Because the species of *Spirogyra* was classified by shape and color of conjugations and fully-ripened zygospores formed in sexual reproduction (Yamagishi, 1966; Hirose and Yamagishi, 1977), determination of the exact species is very difficult. Nozaki and Mitamura (2002) had been culturing a *Spirogyra* sp. isolated from the north basin of Lake Biwa under laboratory conditions from September 1999 to August 2000. However, conjugation and zygospores of this alga were not formed. Since neither conjugation nor zygospores of this alga have been described in previous studies, the species propagated in Lake Biwa remains unknown. Graham et al. (1995) reported the same result as Nozaki and Mitamura (2002) using a *Spirogyra* sp. isolated from Surrey Lake in the United States. In order to identify the *Spirogyra* sp. propagated in the north basin of Lake Biwa, conjugation and zygospores of this alga should be collected from field studies.

In the present report, photographs of conjugation and zygospores of the *Spirogyra* sp. were obtained for the first time in the north

basin of Lake Biwa.

Methods

This study was carried out in a littoral stony zone near Mizugahama (Chomeiji, Oumi-Hachiman City of Shiga Prefecture) located on the eastern coast of the north basin of Lake Biwa on 23 June 2005. More information about the location of sampling site was described in Nozaki and Mitamura (2002) and Nozaki (2004). The bottom of the site was covered with gravel (grain diameter 10-20 cm) and macrophytes were not present. Water temperature was measured with a thermometer. Underwater light intensity was measured with an underwater illuminance meter (Minolta, T-10).

Three samples of benthic algae-dominated *Spirogyra* sp. were collected from stones in the respective quadrates (25 × 25 cm²) at 32-35 cm depths. The algae were removed from the stones using a steel brush. All the samples were stored in an ice-box and were returned to the laboratory within 3 hours after sampling. Each sample was filtered on a glass fiber filter (Advantec, GA-100) in preparation for analysis of chlorophyll *a* (Lorenzen, 1967). Filaments of *Spirogyra* sp. were observed under optical microscope (Olympus, BX 51), and photographs of conjugation and zygospore were taken by digital camera (Olympus, Camedia C-5060).

Results and Discussion

Water temperature at the sampling site at 11:00 AM was 23.2 °C ,

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and the underwater light attenuation coefficient (k) was 0.332 m^{-1} . A filamentous green algal mat formed by *Spirogyra* sp. covered with stones had a thickness of 10-20 cm. Chlorophyll a of the benthic algal community was 441 ± 55 (mean \pm SD) mg m^{-2} . Cell numbers of a *Spirogyra* sp. were 85500 ± 16000 (mean \pm SD) cells cm^{-2} . From comparison with previous studies (Nozaki, 2001; 2003), the *Spirogyra* sp. was considered to propagate well on the sampling date.

Figure 1 shows the filament (a) and rhizoid (b) of a *Spirogyra* sp. propagated at the sampling site. Width and length of cylindrical cells were about 30-50 μm and 120-240 μm , respectively. The cells contained four chloroplasts and plane end walls. The same type of alga was observed at Kita-Komatsu (Nozaki, 1999; 2001, 2004) and Kaizu-Oosaki (Nozaki, unpublished observation; study site of Ishida et al., 2006). Figure 2a ($\times 100$) and 2b ($\times 200$) show the conjugation and zoospores of a *Spirogyra* sp. Conjugation formed by two different filaments was scalariform type. Fertile cells inflated both sides. Zygosporangia were ellipse-shaped, and the pattern of medium spore wall was probably smooth. Diameters and lengths of the zygosporangia were 30-40 μm and 60-80 μm , respectively. The collected zygosporangia did not fully ripen, so the species could not be confirmed.

In order to definitively identify the *Spirogyra* sp., factors affecting the conjugation and zygosporangia formation should be detected from field and laboratory studies.

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摘 要

琵琶湖北湖沿岸帯で繁茂するアオミドロ (*Spirogyra* sp.) の接合体と接合胞子

野崎健太郎

琵琶湖北湖の沿岸帯で繁茂する糸状緑藻アオミドロ (*Spirogyra* sp.) の接合体と接合胞子の写真を初めて記載した。試料は琵琶湖北湖東岸の水が浜 (滋賀県近江八幡市) で2005年6月23日に採集された。接合の型は、異なる2本の糸状体による梯子接合であった。雌性配偶子嚢は、両側に膨張した。接合胞子の形はだ円であった。採集された接合胞子は完熟ではなく種名の決定には至らなかった。

キーワード: アオミドロ, 糸状緑藻, 接合体, 接合胞子, 琵琶湖

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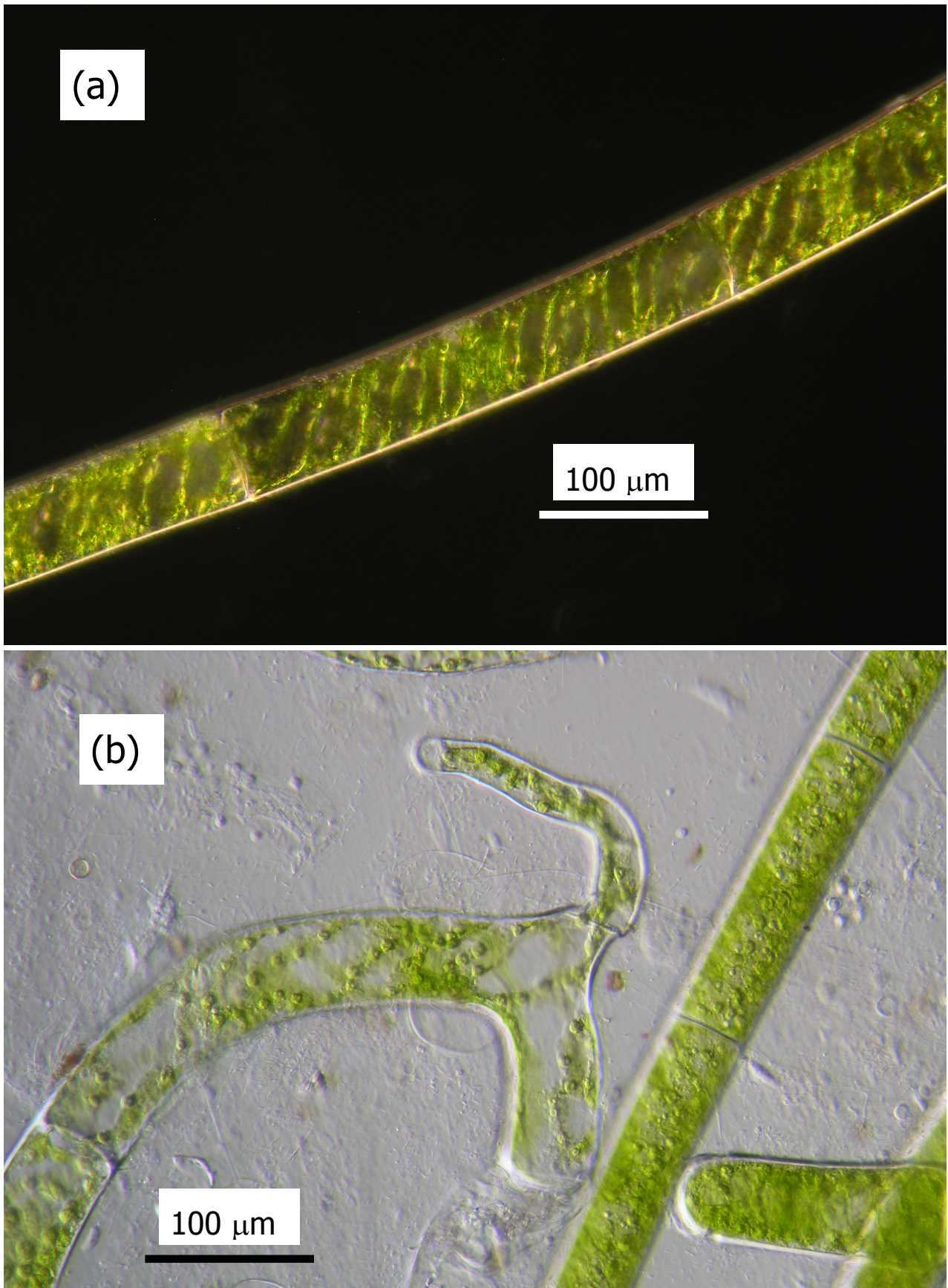


Fig. 1. Photographs of filament (a $\times 200$) and rhizoid (b $\times 200$) of a *Spirogyra* sp.

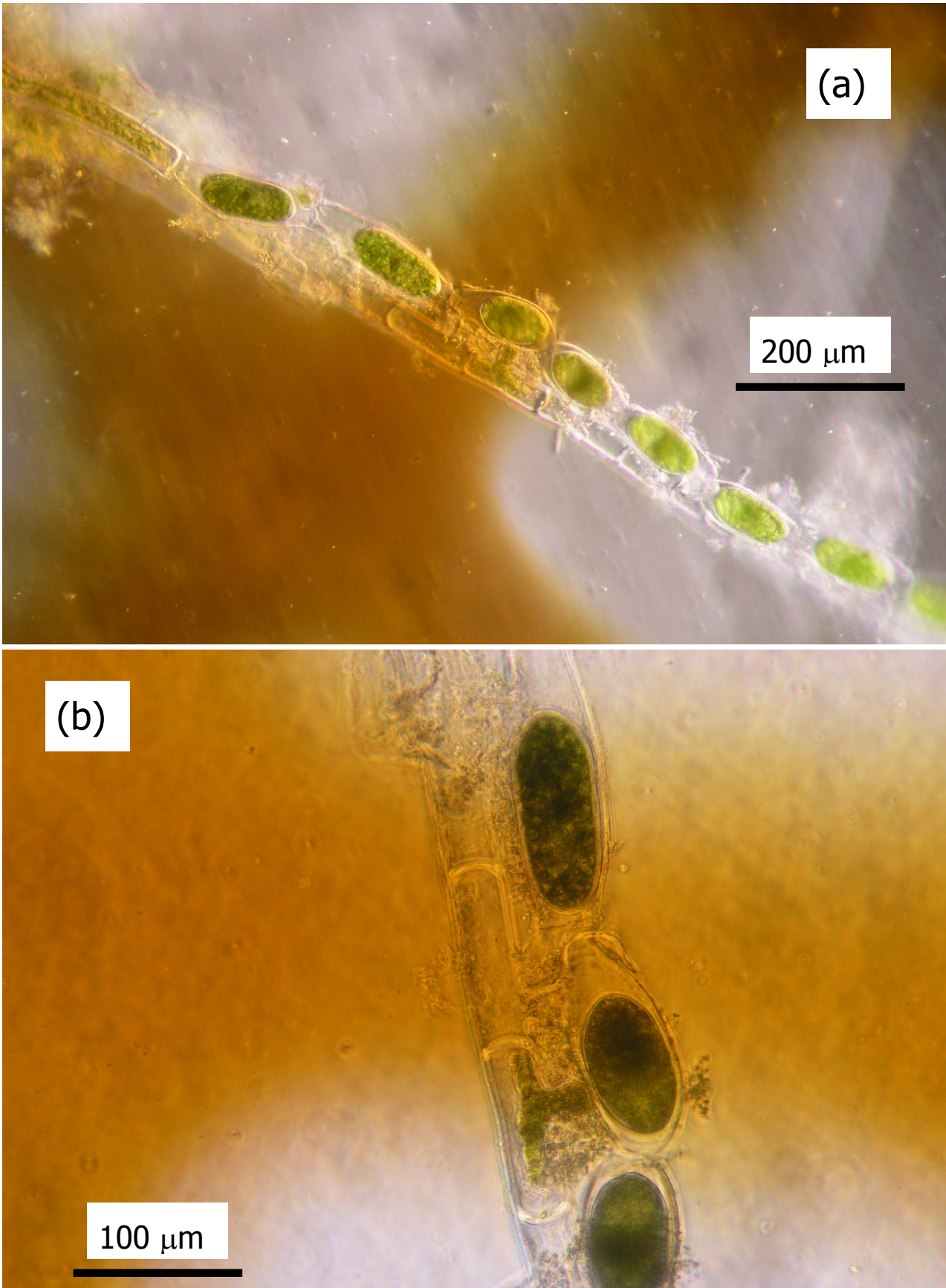


Fig. 2. Photographs of conjugation and zoospores of a *Spirogyra* sp. (a) $\times 100$, (b) $\times 200$.