

***Batrachospermum hirosei* Ratnabapathy et Kumano, a Freshwater Red Alga New to the Philippines**

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ABSTRACT: One freshwater red alga, *Batrachospermum hirosei* Ratnabapathy et Kumano, is recorded for the first time from the Philippines. It was found to be attached on the submerged stones near the river in Palogtoc Falls, San Roque, Bulusan, Sorsogon Province. In this study, morphological and reproductive structures of *B. hirosei* are described in detail. We also discuss the biogeographic issue of this entity.

KEY WORDS: *Batrachospermum hirosei*, Freshwater red algae, Morphology, New record, Rhodophyta, The Philippines.

INTRODUCTION

Most of the taxonomic studies of freshwater algae in the Philippines have focused on microalgae (Pantastico, 1977; Martinez, 1978, 1983; Tamayo-Zafaralla, 1998). Only few studies dealt with macroscopic forms while those on freshwater red algae are sporadic (Skuja, 1934; Krishnamurthy, 1962; Kumano and Liao, 1987; Liao and Young, 2000; Sherwood and Sheath, 2003). The first report of freshwater red algae in the Philippines was made by Skuja (1934) who described a new genus and species, *Nemalionopsis shawii* Skuja, within the family Thoreaceae.

In 1962, Krishnamurthy reported two new additional records of freshwater red algae, *Compsopogon coeruleus* (Balbis) Montagne and *C. aeruginosus* (J. Agardh) Kützing, within the family Compsopogonaceae based on specimens collected from Palomar, Manila and Los Baños by W. R. Shaw in 1911 and E. A. Quisumbing in 1929, respectively. Twenty-three years later, Liao and Largo (1985) reported an undescribed species of *Batrachospermum* based on the materials collected by Schoenig and Tumilap during an expedition to Nonoc Island in 1984. This species was subsequently described as a new species, *B. nononcense* by Kumano and Liao in 1987.

Recently, two freshwater red algae, *Thorea violacea* Bory de Saint-Vincent and *Hildenbrandia angolensis* Welw. ex W. West et G. S. West, were reported from Matutinao River in southwestern Cebu (Liao and Young, 2000) and Sto. Ninjo Cold Spring in Camiguin Island (Sherwood and Sheath, 2003), respectively. At present, there are only six species in five genera of freshwater red algae reported from the Philippines.

In this study, we collected a freshwater red alga, identified as *Batrachospermum hirosei*, from Bulusan, Sorsogon Province, the Philippines on February 19, 2003. Morphological and reproductive characters of this species are described. This species is a new record to the Philippines.

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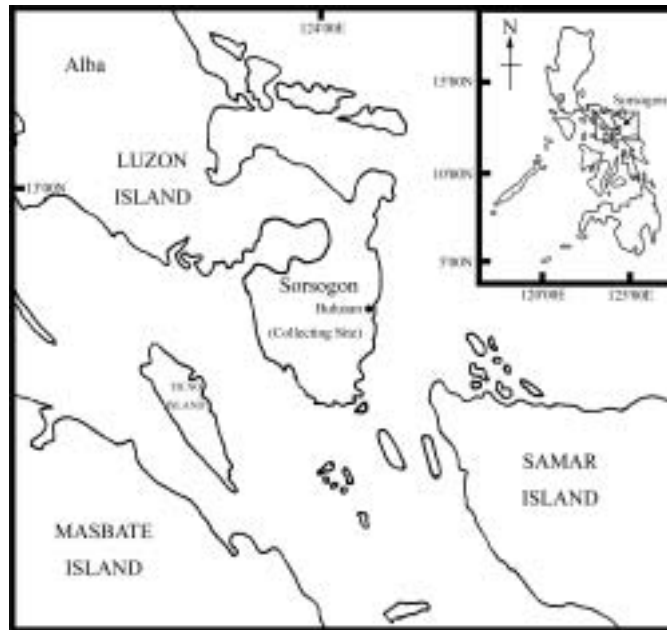


Fig. 1. Collecting site in Bulusan, Sorsogon Province, the Philippines.

MATERIALS AND METHODS

The materials were collected from Palogtoc Falls, San Roque, Bulusan, Sorsogon Province, the Philippines (Fig. 1) on February 19, 2003. Plants were collected by snorkeling. All materials examined were preserved in 5-10% formalin/freshwater or dried as herbarium specimens. The liquid preserved specimens were used for detailed examination. The vegetative and reproductive structures were examined by using a light microscope under 200 \times , 400 \times (Zeiss Axioskop 2) and a dissecting microscope (Zeiss Stemi SV11). Photographs were taken by a Zeiss light and dissecting microscope with a camera (Zeiss MC80) or through a cool CCD system (Pixera Penguin 600CL with Automontage Software, CA, USA). Specimens in this study are deposited in Department of Biology, National Changhua University of Education, Changhua, Taiwan.

OBSERVATIONS

Batrachospermum hirosei Ratnasabapathy et Kumano 1982.

Figs. 2A-2G, 3A-3G

Basionym: *Batrachospermum hirosei* Ratnasabapathy et Kumano 1982: 122, Figs. 3A-3I.

Vegetative structures: Plants are dark green in color and up to 2 cm high (Fig. 2A). Thalli are subdichotomously branched and slightly mucilaginous (Figs. 2B-2C). Branches are 300-350 μ m wide in young thalli (Fig. 2B) and 100-200 μ m in mature thalli (Fig. 2C). The branchlets are cut off from the axial cells (Fig. 3A), and then develop to form the whorled branchlets (Fig. 2B). A distinct whorl branchlet system was observed in young thalli (Fig. 2B), while indistinct in mature thalli (Fig. 2C). Branchlets are numerous branching and consist of 10-16 cells in young thalli, but 6-12 cells in mature thalli. Branchlets densely cover all the internodes in young thalli, but often deciduous in mature thalli. The cells of the branchlet are fascicles, fusiform or ovoid, 4-8 μ m wide, 4-15 μ m long, with no terminal hair cells (Fig. 2D). Cortical filaments are well developed.

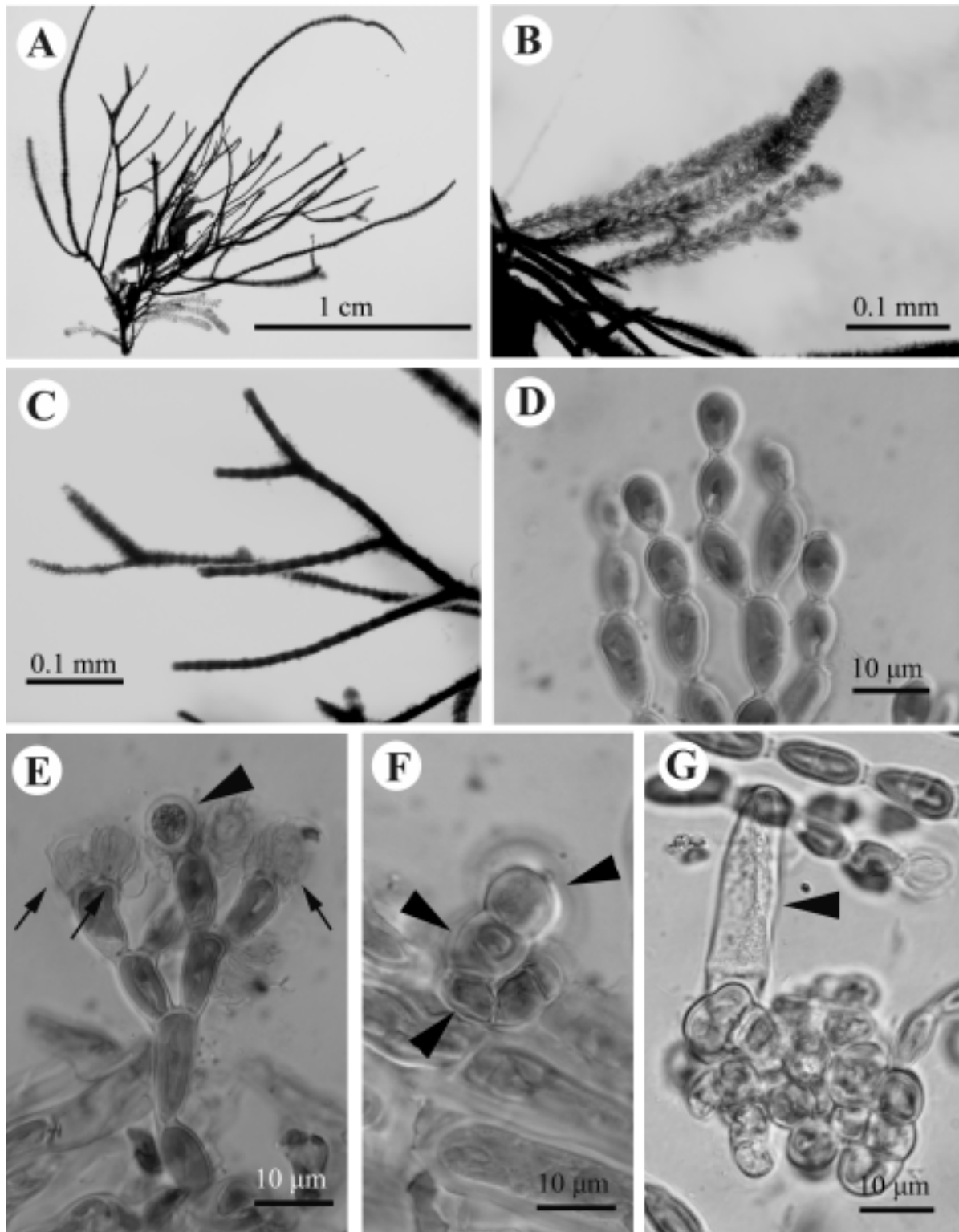


Fig. 2. *Batrachospermum hirosei* Ratnasabapathy et Kumano. A: Habit of the thalli. B: Young branches showing the distinct whorl branchlets. C: Subdichotomous old branches showing sparse whorl branchlets. D: Terminal cell of branchlet without terminal hair. E: Spermatangia (Arrowhead) and the wall of empty spermatangia (Arrows) at terminal position of the branchlet. F: Young carpogonium-bearing branch (Arrowheads). G: Mature carpogonium showing long spatula-shape trichogyne (Arrowhead).

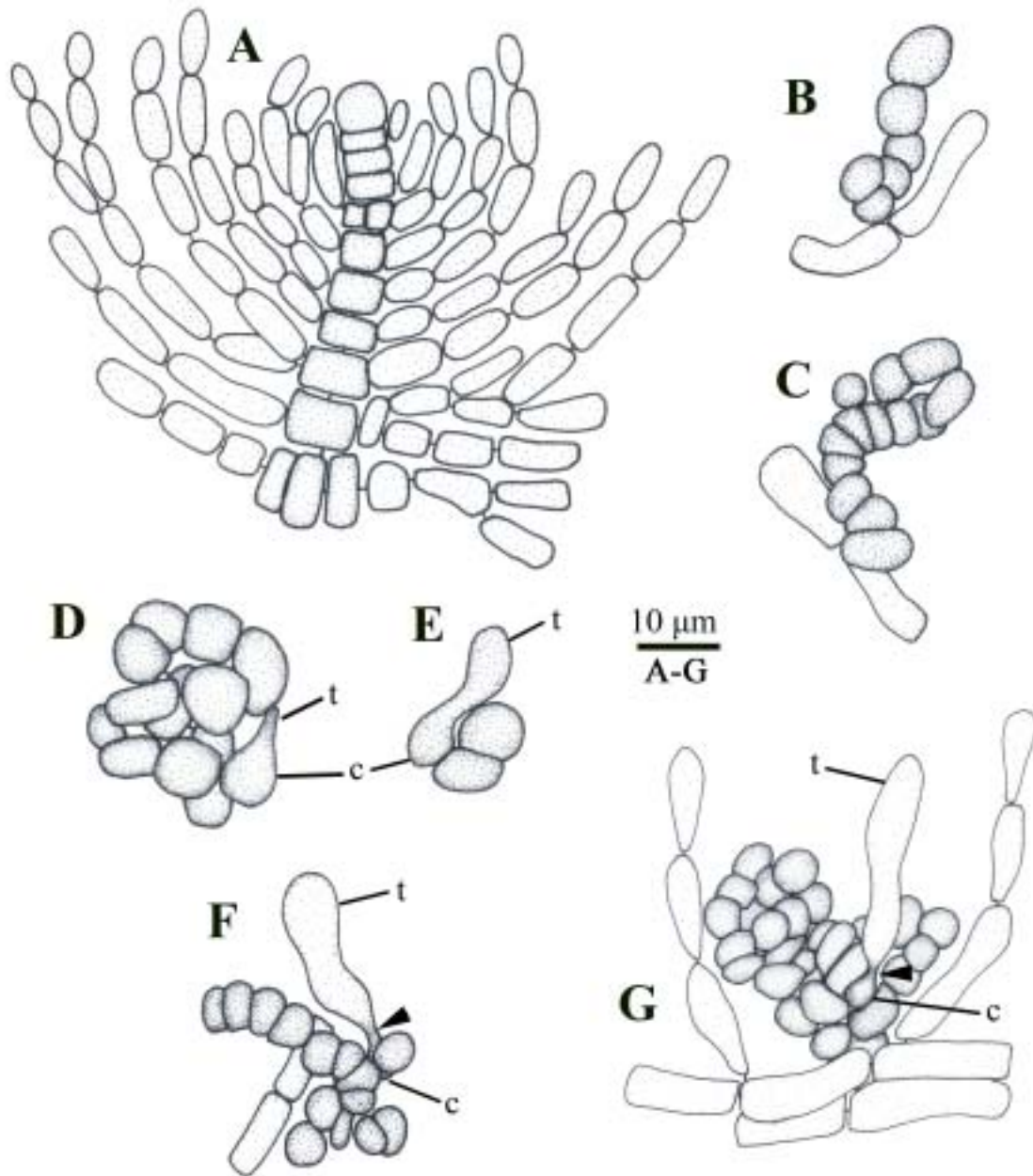


Fig. 3. *Batrachospermum hirosei* Ratnasabapathy et Kumano. A: Acropetal growth pattern of branchlets. B-C: Young carpogonium-bearing branch arising from the axial cell and showing the curving growth pattern. D-F: Carpogonium showing the extension of trichogyne with a distinct stalk (Arrowhead). G: Mature carpogonium-bearing branch showing spiral and twisted growth pattern and a long spatula-like trichogyne with a distinct stalk (Arrowhead). Abbreviations: c, carpogonium; t, trichogyne.

Reproductive structures: Plants are monoecious. Spermantangia are globose, 3-5 μm in diameter, terminally produced on the branchlets (Fig. 2E). Carpogonium-bearing branch arises from the basal cell of branchlet, strongly twisted, 4-6 μm in diameter (Figs. 2F, 3B-3C). Carpogonia develop long trichogynes in more matured carpogonium-bearing branches (Figs. 3D-3F). The trichogyne is ellipsoidal or irregularly spatula-shaped with distinctive stalk, 6-8 μm wide, 25-38 μm long (Figs. 2G, 3F-3G). No gonimoblast was observed.

Specimens examined: Palogtoc Fall, San Roque, Bulusan, Sorsogon Province, the Philippines, coll. S.-L. Liu, L.-M. Liao and W.-L. Wang, BaHi92021901, 19 February, 2003.

Type locality: Sungai Pusu near Kampong Sungai Pusu, Selangor, Malaysia.

Habitat: Plants are epilithic on the submerged stones in well aerated, moderately agitated, and clear stream with a depth of 20-50 cm.

Distribution: Peninsular Malaysia and the Philippines.

Remarks: *Batrachospermum hirosei* is very similar to *B. intortum* Jao and *B. nonocense* Kumano et Liao. Those species belong to the section Contorta which have a strongly twisted carpogonium (Sheath and Vis, 1992). In our material, monosporangia and terminal hair cells are absent. In *B. intortum*, monosporangia are usually observed (Ratnasabapathy and Kumano, 1982). In *B. nonocense*, terminal hair cells often persist (Kumano and Liao, 1987). Although these three species are similar in morphology, our material is in agreement with the description of *B. hirosei* in its being monoecious, small thallus size, lacking monosporangia and lacking terminal hair (Ratnasabapathy and Kumano, 1982). These characters are also useful in distinguishing it from the other species of *Batrachospermum* within section Contorta (Kumano, 2002).

DISCUSSION

Anton *et al.* (1999) reported that many species of the genus *Batrachospermum* are endemic in the Indo-Malaysia North Australia phycogeographical region (IMNAR) due to its geographical isolation. *Batrachospermum gombakense* was recently reported from Sabah, Malaysia and was attributed to freshwater red algal migrations (Anton *et al.*, 1999). They speculated that the migration of freshwater red algae within IMNAR was affected by human and biotic dispersal during the last glacial maximum in the Quaternary period. At that time, the lower sea levels caused many islands within IMNAR to form connections to the continental mainland. In this paper, *B. hirosei* is reported as a newly recorded species for the Philippines for the first time since it was found in Peninsula Malaysia in the past (Ratnasabapathy and Kumano, 1982). Obviously, the migrating situation and distributive pattern of *B. hirosei* are similar to the one of *B. gombakense* (Anton *et al.*, 1999). Such information contributes to our knowledge of paleobiogeography of *Batrachospermum* within IMNAR.

Up to now, there are totally seven species in five genera of freshwater red algae reported in the Philippines. There should be more taxa of freshwater red algae undiscovered in the Philippines as evidenced by numerous reports from its neighbor countries (Anton *et al.*, 1999). More investigations and field collections should be done in the future for exploring a rich algal flora in the country.

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菲律賓新紀錄淡水紅藻 *Batrachospermum hirosei* Ratnabapathy et Kumano

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摘 要

本文報導一種菲律賓新紀錄淡水紅藻 *Batrachospermum hirosei* Ratnabapathy et Kumano。此種紅藻分佈於菲律賓 Sorsogon 省的 Palogtoc 瀑布鄰近乾淨清澈溪流的石頭上。本文除對於此種藻類的形態作詳細描述外，也對其地理分佈問題作討論。

關鍵詞：*Batrachospermum hirosei*、淡水紅藻、形態、新紀錄、紅藻、菲律賓。

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