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POLYMORPHISM IN *LYNGBYA NOTARISII* (MENEGHINI) WILLE IN CULTURE

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Morphology of blue-green algae or cyanobacteria may be influenced by environmental factors making identification very difficult. Drouet and Daily (1956) recognized only six genera of coccoid blue-green algae from about four and one-half of a dozen of genera. Drouet (1981), after examining a large number of herbarium specimens including the types of many taxa of Stigonemataceae, considered all the genera as synonyms of *Stigonema*. Aziz (1989) documented *Hapalosiphon, Fischerella* and *Stigonema*-like habits of a non-thermophilic blue-green algal strain D612 in axenic culture and considered all these forms/habits of organisms as *Stigonema***.** Based on culture studies of strains designated as *Hapalosiphon, Mastigocladus, Westiellopsis, Fischerella* and *Stigonema*, Begum *et al.* (1994) suggested to consider these truly branched forms as *Stigonema*-complex.

On 26 November 1995, a brownish-pink filamentous algal sample was collected along with dry coconut palm-bark from Panchagar district, Bangladesh. It was found to contain brownish-pink filaments with thick sheath that is frayed at the tips and was identified as *Porphyrosiphon notarisii* (Menegh.) Kütz. 1850 (Fig. 1) (Desikachary 1959, 248, Pl. 47, Fig. 9; Starmach 1966, 425, Fig. 630).

The genus *Porphyrosiphon* Kütz. 1849 is separated from *Lyngbya* Ag. 1824 by having a multilayered sheath with a red or brown pigment (Bourrelly, 1985). *Lyngbya aestuarii* Liebn. *ex* Gomt., *L. maior* Menegh. *ex* Gomt. 1892 and *L. majuscula* Harv. *ex* Gomt. 1892 produce multilayered sheath (Starmach, 1966, Figs 338, 343 and 345, respectively). The coloured filament is due to the production of scytonemin pigment to protect the cyanobacterium from near UV radiation (Muehlstein and Castenholz, 1983).

Many of the features mentioned in the literature of *Porphyrosiphon* have been highly variable and resemble *Lyngbya majuscula* (Desikachary 1959). In *L. ceylanica* Wille, Aziz and Tanbir (1999) observed variation in colour, being reddish-brownish in upper filaments that received more light when grew on moist rice-field soil (Fig. 2), with dimensions very similar to *Porphyrosiphon*. Drouet (1937) included *Lyngbya arboricola* Bruhl *et* Biswas and *L. dendrobia* Bruhl *et* Biswas under *Porphyrosiphon notarisii*.

To ascertain the identity and also the variability in regards to nature of filaments, a portion of the bark sample with brownish-pink layer was placed in a Petri dish containing Chu 10D medium, incubated at a continuous light quantity of about 50 μE m^{-2} s^{-1} and a temperature of about 25º C. Many hormogonia of 4 to 9 (−20) cells were found to be released, develop into blue-green filaments. After about 15 days, many filaments attaining about 3 cm long developed centering the bark (Fig. 3). Initially filaments were blue-green with relatively thin non-stratified sheath like *Lyngbya* (Fig. 4). But later on some filaments produced false-branches like *Plectonema* Thur. (Fig. 5), while many filaments became purplish to reddish-brown with 10−12-layered sheath like *Porphyrosiphon* (Figs 6, 7), even more than that found in nature (Fig. 1). Further growth resulted much wider filaments with 2 or 3 trichomes within highly thickened rigid sheath (Figs 8, 9) that

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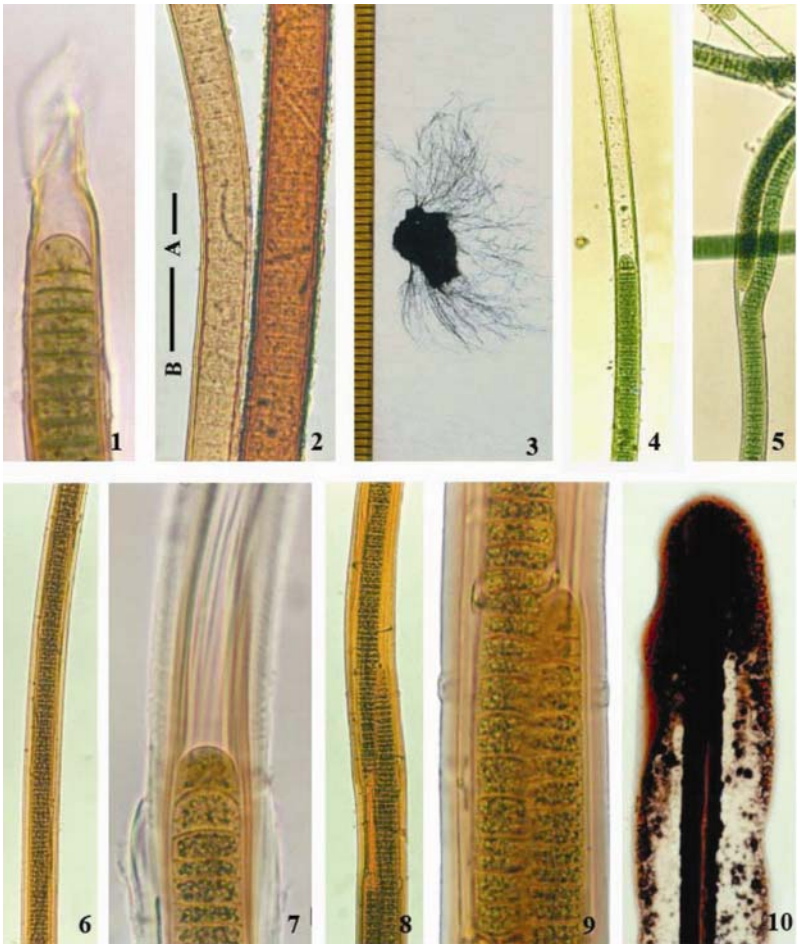
did not gelatinize like *Microcoleus*. When a reddish-brown filament was placed on a glass slide with water and exposed to sunlight for two days, huge quantity of reddish-brown water-soluble pigment scytonemin was formed, some amount came out of the filament through open end of the sheath (Fig. 10). The released scytonemin after drying formed dark coloured crystals posteriorly. However, the scytonemin produced by cells was diffused into a few innermost sheath layers but not the outermost one(s) (Figs 8, 9).



Figs 1−10. *Lyngbya notarisii* (Menegh.) Wille 1914: 1. *Porphyrosiphon*-like filament with frayed sheath and very identical cell dimensions in Figs 1 & 7. 2. Filaments of *Lyngbya ceylanica* from rice-filed soil differing in colour but with similar thickness of sheath. 3. A bark sample in liquid Chu 10D culture medium producing many filaments. 4. *Lyngbya*-like filament from the culture. 5. A false-branched filament like *Plectonema*. 6. *Porphyrosiphon*-like filament with multilaminated red-brown sheath from the culture. 7. An enlarged terminal part of the *Porphyrosiphon*-like filament from the culture; note variation in sheath colour. 8. A *Microcoleus*-like filament with three trichomes inside the parent sheath. 9. An enlarged part of the filament with two trichomes showing details; note the absence of gelatinous sheath. 10. Formation and release of huge scytonemin on a glass slide after exposure to sunlight of a cultured red-brown filament in water; note the trapped scytonemin within the filament and release through open end. Bars = 25 µm: Bar A is for Figs 4−6, 8, 10; Bar B is for Figs 1, 2, 7, 9. Fig. 3 = scale is in millimeter.

In the culture, the developed false-branched filaments (Fig. 3) resembled the genus *Plectonema* (Desikachary 1959, 434, 438, Pl. 83, Figs 1, 8). The false branches were produced in young filaments due to rapid growth of intercalary hormogonia that created pressure on relatively thin sheath and came out by rupturing it like that of *Scytonema* with heterocysts. At lamellated thick-sheath stage, the new trichomes, grew side by side (Figs 8, 9), a feature of *Microcoleus* Desmaz. 1823, but here the gelatinous sheath was absent. Castenholz (1989) noted that the genus *Porphyrosiphon* is known primarily for a single trichome within a red to red-brown laminated sheath, although occasionally it is with more than one trichome per sheath, the feature reflecting polymorphic nature as is found in the present study. Because of similarities, *Lyngbya, Phormidium* Kütz. 1843 (narrow sheathed *Lyngbya*-like filaments forming an irregular mucilaginous mat) and *Plectonema* are considered as LPP group (Rippka *et al*., 1979). The sheath thickness and colour development in filaments appeared to be due to age and light effects, respectively. *Lyngbya notarisii* (Menegh.) Wille is polymorphic where the growth forms like the genera *Plectonema* and *Porphyrosiphon* were found. Considering these facts, the genera *Plectonema* Thuret 1875 and *Porphyrosiphon* Kütz. 1850 (*P. notarisii* (Menegh.) Kütz., monotypic) are considered as the synonyms of the genus *Lyngbya* Ag. 1824.

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