A study of mucilage in light microscope photographs acquired by using a different painting material of *Gomphonema* sp.

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This research was based on the patterns of *Gomphonema* sp. obtained from Lake Hazar (Elazığ, Turkey), which has a high alkali feature. It was carried out by monitoring the live samples of patterns isolated from the littoral part of the lake, which was painted by a different material. It is known, to date, that India ink has been widely used in the painting of live algal sample. In this research, hematoxylen solution, which was commonly used in obtaining images from histologic isolated sample by using light microscope, was used instead of India ink. Incredibly, findings have been spotted in this research, which was carried out for the purpose of photographing the mucilage morphology of *Gomphonema* sp. in a clearer and more significant sense. Thus, this study was photographed under light microscope that in live isolated samples, dyed by hematoxylen, the cells belonging to *Gomphonema* sp., which was in the phase of cell division, was completely covered in mucilage and the division was over the mucilage disappearance. The fact that no findings were detected in the literature investigation so far, regarding the taxon belonging to Gomphonemataceae, covered the surrounding mucilage of the cell that completely increased the importance of the data obtained by this research.

**Keywords:** *Gomphonema*, diatom, mucilage, Lake Hazar, Turkey.

**INTRODUCTION**

Many phytoplanktonic cells produce mucilage. In most of these cells, mucilage has a specific feature for taxon. Mucilage's presence, thickness and form depend on taxon and often, the environmental factors also play an important role in this change. However, mucilage provides many advantages for algae. These advantages can be summarized as: increasing buoyancy by reducing the cell density in the photic zone, diminishing the friction effect and flow by aerodynamic form, enabling the cell to survive under negative conditions by forming a cyst structure, and food storage. Besides, mucilage is a form, which enables the cell to survive in low oxidative environmental conditions in terms of food. Mucilage is also responsible for being more resistant to alga in grazing and digestion (Reynolds, 2007).

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**MATERIALS AND METHODS**

**Preparation of hematoxylen**

100 g of potassium alum was dissolved in distilled water by heating, and then 5 gm of hematoxylen was melted in 50 ml ethanol. When
the mixture of water and potassium alum was added, it began to boil and the solution prepared with hematoxylen alcohol was added slowly to the mixture. Then 2.5 gm of mercuric oxide was added to the solution and it was left to cool down. When the solution begins to cool, it was left for 24 h. Then 40 ml Glacial acetic acid was added to the solution, after which it was filtered before it was used (Doran, 1997).

**Completion of Gomphonema sp. patterns and preparation of live isolated sample**

Gomphonema sp. patterns, which have a dense population in the littoral zone of the lake, were collected from the surface of the stones and brought to the laboratory in a short time and the live isolated sample was prepared. The isolated sample of Gomphonema sp. was transferred to a slide microscope, then one drop of hematoxylen was added, after which it was then covered by the lamella. It was examined and photos belonging to patterns were obtained under light microscope (Karl-Zeiss Jena mark and Jena-Med (jena2) model binocular light microscope) after waiting for 5 min before painting the sample.

**RESULTS AND CONCLUSIONS**

Individuals of Gomphonema sp. genus are generally adapted to benthic life (Van Landingham, 1978) and are among the dominant representatives group of pennate diatoms which are abundant in freshwater algal flora (Kociolek and Stoerner, 1988a, b, 1993). Besides, some members of this group known as reophil alga are pretty common in the Lake Ecosystem too, although it is not possible to generalize ecological habitat dispersion especially in the genus level (Hustedt, 1930; Wehr and Sheath, 2003). There are lots of investigations performed by electronic microscope in the literature regarding the morphological forms of some important and common kinds of species in Gomphonemataceae (Dawson, 1972, 1973; Ueyama and Kobayashi, 1988; Lange-Bertalot, 1991, 1993; Kociolek and Stoerner, 1993). One of the most important features of this group except for the systematical ones is that they can be fastened on substrates by the help of mucilage stalks in aquatic habitats and can form colonies big enough to be seen. What is more is the fact that Gomphonemataceae is one of the bio-indicators used for determining the increasing water quality.

So far, many scientific works have been performed and published for the purpose of presenting both the diagnostic and ecological features of these groups (Dawson, 1972, 1973; Ueyama and Kobayashi, 1988; Lange-Bertalot, 1991; Kociolek and Stoerner, 1993; Wehr and Sheath, 2003), but rare or no literature was examined in situations where members of Gomphonema sp. present formed mucilage stalk in order to hold on to substrates (stone, vegetative material or any hard matter in the water) in the apical of the cell. The plates of the species of this group under light microscope have been obtained either by directly receiving the cell to the prepare or by dying the prepare using India ink to make it more significant (Wehr and Sheath, 2003). However, regarding Gomphonema sp. dyed using this technique, there is no scientific record that mucilage covers the cell completely except that it forms mucilage shafts. The plates obtained in live preparates, dyed by hematoxylen, are shown in Plate 1.

**Plate 1**

The examined plates showed that before the cell separation, the plates were completely surrounded by mucilage (Plate 1a to c). It was observed that after the diatom cell was completely divided on mucilage shaft, the layer, which circumscribed the cell got deformed (Plates 1d and e) and at the end of the cell division, it was completely removed by the cell (Plate 1f). In the literature, no finding was detected regarding these data. It is known that the taxon belonging to Gomphonemataceae is in the shape of mucopolysaccharides (Wehr and Sheath, 2003). Mucilage production increases in cells whose proteins and amino acids are assimilated by a regulation of the photosynthetic accumulation of food and are deprived of food even when the foods are consumed (especially phosphor) (Margelef, 1997; Reynolds, 2007). It has never been reported in the literature that Gomphonema is completely surrounded by mucilage during cell division. In Lake Hazar, the average pH was determined as 9.15 in situations where the patterns were received. In this context, the lake shows a high alkali feature. Generally, the best pH adaptations for taxon belonging to Gomphonema sp. are between 5.4 (acidic) and 7.4 (neutral) (Wehr and Sheath, 2003). Total hardness amount for the lake ranges between 405 and 460 mg CaCO\textsubscript{3}/L, and therefore the lake water shows a tough nature.

In the region where the research was performed, the average rate of total phosphorus was determined as 61.61 µg/L. From the point of total phosphor, the yearly rate of the Lake according to Whittaker (1975) is salty; while according to OECD (1982) and Vollenweider and Kerekes (1980), the region is a transitional stage from mesotrophic to eutrophic. Reynolds (2007) reported that mucilage production and its amount is unique to algae and that would change depending on the environmental factors. In addition, it is indicated in the same literature that in the case of environmental factors defect, the mucilage rate in algae may rise which is an important adaptation for the alga to survive. Unsurely, the fact that Lake Hazar (where the patterns were obtained) is mesotrophic, having high alkali and lye, may explain why Gomphonema sp. patterns are covered densely by mucilage. However, the reason why these mucilage cells did not cover the cells completely during separation is still unknown. Additionally, the reason why this situation previously did not appear in the preparates prepared by
Plate 1a-f. Division of *Gomphonema* sp. in samples dyed with hematoxylen and functional appearance of musilage during division.

India ink but does appear now in the preparations painted by hematoxylen has not been clarified utterly. Consequently, this group which is abundant in the benthic flora of freshwaters is generally defined as reofil algae and is merely used for sticking mucilage to substrates. The fact that no findings were detected in the literature investigation so far, regarding the taxon belonging to *Gomphonemataceae*, covered the surrounding mucilage of the cell that completely increased the importance of the data obtained by this research.

REFERENCES


