A Study on Diatoms Species in Different Water Bodies in of North Eastern India (Meghalaya)

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ABSTRACT: Diatoms are the micro- organisms commonly used in forensics sciences to differentiate the ante- mortem from post- mortem drowning. In this study, the samples were collected from Mawsynram region of Meghalaya, India to identify the diatom species and an attempt was made to create data of diatoms seen in the different water bodies of Meghalaya. Twenty-two species from different genera were found in different water samples. Among these, Gomphonema and Navicula species were the common genus seen followed by Cymbella and Nitschia. It is hoped that the results of this study would help the forensic experts in proving their reports related to drowning cases involving different water bodies in court of law.

Keywords: forensic Science, diatom, Meghalaya

Introduction

Diatoms are unicellular eukaryote and photosynthesising algae found in almost all the aquatic environments. They are non-motile or capable of only limited movement along the substrate by secretion of mucilaginous material along with a channel-like called raphe [1,2].

Macrospically diatoms appeared yellow tint due to present of photosynthetic plastids. They can also appear in brown or black colours when they are observed in larger masses [3,4]. Microscopically, they appeared as unicellular with the size around 20-200 microns. The cell wall is composed of silica (SiO_2) which refers as the frustules and organic material that coat the valves and girdle. The frustules consist of two valves. The larger, older valve of the frustules is known as epitheca. The smaller, younger valve of the frustules is known as hypotheca. The lateral lip or rim of the epitheca is called as epicingulum and the epicingulum fits over the hypocingulum of the hypotheca. The frustules can vary greatly in shape which can be symmetrical or asymmetrical. The girdle is made up of one or several connective bands of epicingulum and hypocingulum. Septa are partitions that are form with in the valves. The pinnate diatoms contain a raphe which is mainly for the movement of the diatoms. The raphe is a space that actually separates the valves [1-4].

Diatoms are phytoplankton belong to the division Chrysophyta, class Bacilloriophyceae, which are further divided in two orders based on their morphology: Centrales which have valve striae arrange basically related to a point, an annulus or a central areola and appear radially symmetrical. Pennates are also called as bacillariales which have valve striae arranged in relation to a line and tend to appear bilaterally symmetrical. The skeletal features are used to classify and describe diatoms. The classification system places the centric diatoms into three sub-orders, namely Coscinodiscineae, Rhizosoleniineae and Biddulphiineae. The pennate is further divided into two sub orders which are Flagillariineae and Bacillariineae [1,3].

Commonly diatoms are the primary food source for many invertebrates and some fishes. They are commonly used as indicator for the degree of salinity because they are very sensitive in changing the salt content in water. Diatoms also play a major role in forensic investigation, when drowning takes place the diatoms present in the medium, they enter through the ruptured capillaries via penetration into the alveolar system, to blood stream and further distant organs and others tissue. They are mainly used to differentiate the anti-mortem from the post mortem drowning.

In the past few years, many studies have been done in India from different water bodies of different regions and the species specific data had been generated by different authors [8-15]. Most of the studies were done in order to access diversity and distribution of diatoms species in relation to the balance eco-system studies based on the population and the climate. In additional, there were also studies conducted in different part of the world [6,7,16] and India in forensic specific investigations to connect the water body, the object, victim and assailant and also to determine the cause of death, the place of drowning and also to access the anti-mortem and post- mortem drowning [5,9-12].

To the best of our knowledge, there is no study conducted on the water bodies of Meghalaya for generation of data of diatom species for the forensic research purpose. The objective of the present study is to isolate and identify the diatoms species from the water bodies collected from the different parts of the state of Meghalaya, India. We hope to generate the data on the diatoms species distribution specific to the water bodies of Meghalaya so that this will be useful for different scientists, biologists and forensic experts and investigating officials to facilitate the investigation by means of diatoms evidence.

Materials and methods

The region under study has a subtropical climate with an extraordinary rainy and lengthy monsoonal season. The present study region of Mawsynram is at 25° 18' N, 91° 35' E. primarily due to the high altitude, it seldom gets truly hot in this region. The averaged monthly temperature ranges from 10 °C (in January) to 20 °C (in August). This region experience a brief but noticeably drier season from December until February.

The site for water bodies were selected randomly for the study. Fresh water sample was collected in a sterile bottle without any preservation during the winter of 2013. Slides were prepared by staining with Lugol's iodine. 10 mL of the water sample was taken in a clean test tube and 2 mL of Lugol's iodine was added to it. It was then incubated at room temperature for 2 hours. After incubation, the sample was centrifuge at 5000 rpm for 15 mins. After centrifugation, the supernatant was removed without disturbing the sediment. A drop of the thick sediment was taken in a clean glass slide and covered it with cover slip. The slide was then observed under light microscope in different magnification. Taxonomical identification was made by consulting various litterature and monographs.

Results

After the microscopy examination of the entire samples, 22 different species of diatoms were identified from different water samples. The species identified are shown in Fig. 1-22 and Table 1.

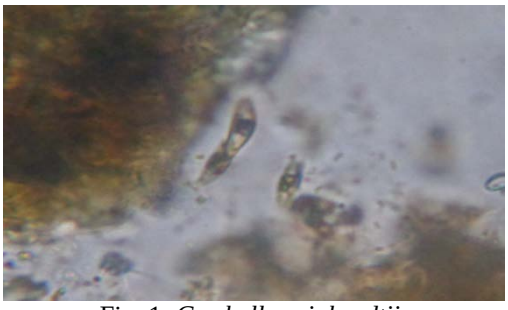

Fig. 1: *Cymbella reinhardtii*

Fig. 2: *Naviculla cryptocephalla*

Fig. 3: *Cymbella lanceolata*

Fig. 4: *Gomphonema vibrio*

Fig. 5: *Naviculla sphaerophora*

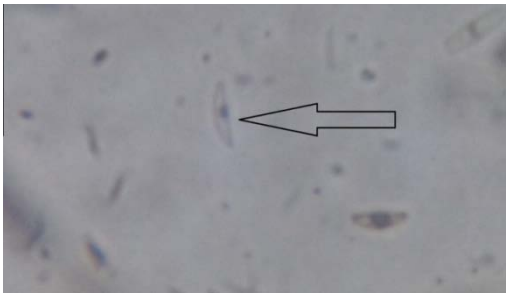

Fig. 10: *Cymbela Umplificata*

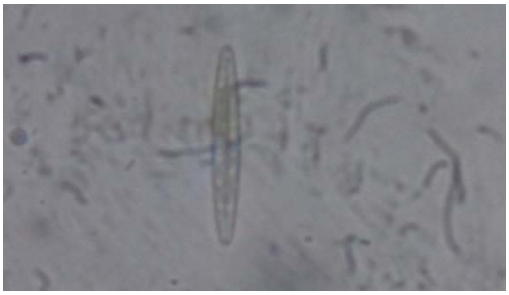

Fig. 6: *Navicula viridula*

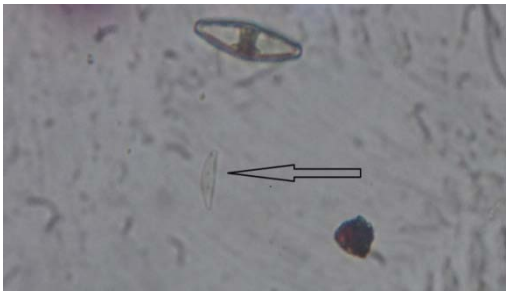

Fig. 11: *Cymbella Affinis*

Fig. 7: *Navicula Cuspidata*

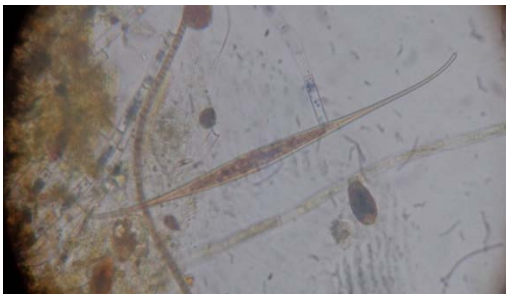

Fig. 12: *Nitszhia acicularis*

Fig. 8: *Navicula Tripunctata*

Fig. 13: *Navicula Amphirhynchus*

Fig. 9: *Navicula Lanceolata*

Fig. 14: *Gomphonema Hebridense*

Fig. 15: *Navicula Producta*

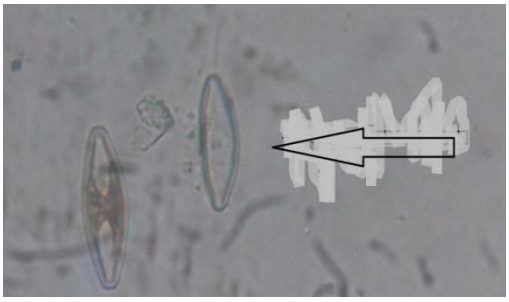

Fig. 16: *Cymbella Turgidula*

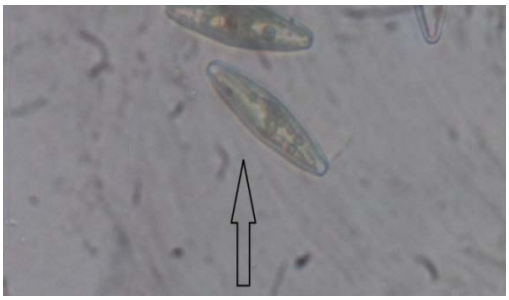

Fig. 17: Nitschia Palea

Fig. 18: *Nitschia Microcephala*

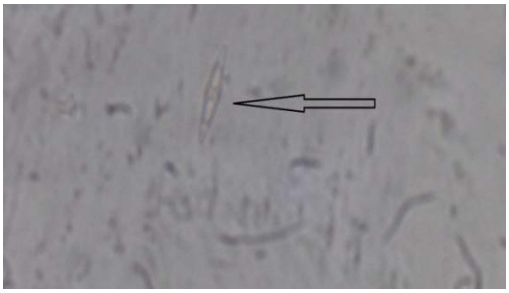

Fig. 19: *Navicula Affinis*

Fig. 20: *Gomphonema Lanceolatum*

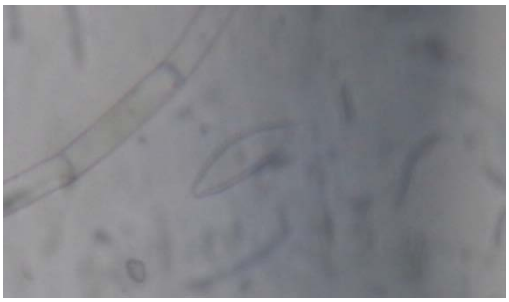

Fig. 21: *Cymbella Tropica*

Fig. 22: *Navicula Trilatera*

Discussion and Conclusion

From the results, it was observed that a total of 22 species of diatoms were predominant from the water sample collected from 5 different water bodies of Mawsynram region in Meghalaya. Inter comparison of the present studies with the previous studies of different part of India shows that most of the diatoms seen in the present studies were also been identified earlier by many scientists and biologists. The species G*omphonema lanceolatum* was found to be very common that present in all the samples. Some of the species were identified only in one particular sample such as *Gomphonema Vibrio, Navicula Cuspidata, Gomphonema Hebridense, Navicula Tripunctata, Navicula Lanceolata, Cymbella Umplificata, Cymbella Turgidula, Cymbella Tropica, Navicula Amphirhynchus, Navicula Affinis, Nitschia Acicularis* and *Nitschia Palea*

Table 1: Data of diatoms species identified in different samples

Sl.No	DIATOMS SPECIES	I	II	III	IV	V	VI	VII	VIII	IX	X
1	*Gomphonema Lanceolatum*	+	+	+	+	+	+	+	+	+	+
2	*Gomphonema Hebridense*	-	-	-	-	-	+	-	-	-	-
3	*Gomphonema Vibrio*	-	+	-	-	-	-	-	-	-	-
4	*Navicula Cuspidata*	+	-	-	-	-	-	-	-	-	-
5	*Navicula Cryptocephalla*	-	+	-	+	-	-	+	-	-	-
6	*Navicula Sphaerophora*	+	-	-	+	-	-	-	+	+	-
7	*Navicula Viridula*	-	+	+	-	-	-	-	+	-	+
8	*Navicula Trilatera*	-	+	+	-	-	-	-	-	-	-
9	*Navicula Tripunctata*	-	-	-	+	-	-	-	-	-	-
10	*Navicula Lanceolata*	-	-	-	-	+	-	-	-	-	-
11	*Navicula Producta*	-	-	-	-	-	+	+	-	-	-
12	*Navicula Amphirhynchus*	-	-	-	-	-	-	+	-	-	-
13	*Navicula Affinis*	-	-	-	-	-	-	-	-	+	-
14	*Cymbella Reinhardtii*	+	+	+	+	+	+	+	-	-	+
15	*Cymbella lanceolata*	+	-	-	-	-	+	+	-	-	-
16	*Cymbella Umplificata*	-	+	-	-	-	-	-	-	-	-
17	*Cymbella Turgidula*	-	-	-	-	-	-	-	+	-	-
18	*Cymbella Tropica*	-	+	-	-	-	-	-	-	-	-
19	*Cymbella Affinis*	-	-	+	+	+	-	-	-	-	+
20	*Nitschia Acicularis*	-	-	+	-	-	-	-	-	-	-
21	*Nitschia Palea*	-	-	-	-	-	-	-	+	-	-
22	*Nitschia Microcephala*	-	-	-	-	-	-	-	+	+	-

(+ = presene of diatoms species, - = absent of species of diatoms)

It is hoped that the results of the present studies would be useful for the forensic scientist community, law enforcement agencies, medico- legal experts and environmental biologist in facilitating their routine investigative and scientific work.

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