



Diatomological Study Of Different Lakes In Salem Taluk, Tamilnadu, India, For Forensic Applications

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Abstract: Diatoms are photosynthetic, single-celled algae with a special silica cell wall called frustules. Diatoms are plenty in all mundane and aquatic ecosystems. Diatoms observed in both fresh and saltwater environments. These microalgae species can grow on moist substrates such as soil and plant bark. These diatom species vary from one area to another due to ecological conditions and surrounding circumstances. Diatoms are important for locating the scene and ascertaining the proximate cause of death in drowning cases. These small entities serve as supporting evidence to determine the type of drowning, whether the victim's death was due to ante-mortem or post-mortem drowning, or whether the person drowned before or after death. In this research study, we collected freshwater samples from ten different lakes in the Salem Taluk, and by using the acid digestion method, an attempt was made to identify and create reference data or a database on the diatom species present in different lakes. By using a trinocular microscope, around fifty-four diatom species were recorded for the first time from various lakes in Salem.

Index Terms – Freshwater, Diatoms, Drowning, Anti-mortem, post-mortem, Acid digestion.

INTRODUCTION

Bacillariophyceae is a type in the kingdom Protista, which consists of unicellular microscopic algae known as diatoms. They are present in all aquatic environments, including fresh and marine water, such as rivers, ponds, lakes, dams, oceans, reservoirs, and etc. Unique species of diatoms ranges from one lakhs to two lakhs with around two hundred genera present. These diatoms are very tiny; with most species having lengths that are range between 2- 200µm. Diatoms are planktonic or benthic¹. These single-celled organisms have a unique cell wall structure composed of hydrated silica known as frustules, consisting of two valves that connect to form a bipartite structure enclosing the cytoplasm. Epi-valve is larger and Hypo-valve is smallest. Identification is based on the structure of valves, which shows differences between species and genera it can be bilateral or radial². Diatoms are classified into two cluster; Centric - circular and Pennate - elongate. The second group pennate diatoms have a raphe (the valves are separated by a space) that primarily serves to move the diatoms; diatoms appear light yellow in colour due to the presence of photosynthetic plastids³.

The analysis of diatoms in field of forensic is considering as a vital tool used to diagnose suspected drowning cases. It commonly involves determining and analyzing the scene of drowning, as well as the cause and manner of death in such drowning cases. These small entities serve as supporting evidence to ascertain the type of drowning, whether the victim's death was due to ante-mortem or post-mortem drowning, or whether the person drowned before or after death. In ante-mortem situations, the individual

still alive and submerged in water. In these cases, some fluid is forced into the lung cavity and compresses the lung wall due to this pressure; the alveoli in the lungs can become torn allowing fluid to enter the bloodstreams. Until the heart stops, water continues to enter the blood, and at this time, some diatoms (if present the water), especially the smaller ones, are propelled to reach large functional parts like liver, kidneys, Brain, and bone marrow. Pulmonary or alveolar pressure helps diatoms in reaching these organs. Diatoms cannot reach the organ in the case where the person already died and thrown to the water source⁴.

The samples detected from a drowned victim are compared to samples collected from suspected drowning site and examined for the presence of diatoms. The observation of twenty diatoms out of a hundred μ l pellet in 10g of lung sample denotes drowning. Diatom and algal Communities can vary from one water body to another. Water bodies with similar chemical and physical compositions will produce similar but not identical diatom communities. Different genera and species of diatoms exist in specific water bodies according to their nutrient and light requirements and therefore vary from one water source to another both quantitatively and qualitatively with climate and seasonal changes. The concentration of diatoms can be affected by several environmental factors such as mineral content in water, temperature, water stratification, acidity, distance from the shore, the depth of sea and tides, etc⁵.

MATERIALS & METHODS

2.1 Study Areas

Ten different water bodies (lakes) from various locations of Salem Taluk, Salem district, Tamilnadu, India, were selected for the Diatomological study, as mentioned in the table 1.

2.2 Collection of water samples

The sampling is done in the months of July and August 2024, and temperature of the water is noted for each water body during sampling. The water samples were collected in neat and clean plastic bottles with tightly fitted caps to avoid contamination. Before the collection of water, plastic bottles were cleaned with plenty of same water media at least 2-3 times. A 500ml of water sample is collected from each water body for the study of diatom species and the water container is properly labeled with time, date, and location of that water body. After collection of samples, 1-2 drops of Lugol's iodine solution are added for preservation.

2.3 Extraction and isolation of the diatoms from water samples

The chemical digestion process using the concentrated nitric acid method is employed to extract diatom from the collected samples⁶. From each of the water sample, 100 ml of water was taken and transferred into an acid-washed glass beaker, which was properly labeled. The Samples were left to stand untouched for 2-3 hours after the addition of conc. Nitric acid and bit of potassium dichromate. Then transfer the acid-mixed samples to a properly labeled centrifuge tube and centrifuge at 3000 rpm for 15 minutes. The centrifugation was carried out repeatedly for three times to increase the concentration of the pellet. Each time, the supernatant was pipetted out leaving only the residual materials. This residual material was suspended in distilled water and centrifuged again in the same manner to ensure that even the traces of acid were removed. After final centrifugation, except for 1ml, the entire supernatant was discarded by pipetting. The leftover aspirate was poured over a clean microscopic glass slide is dried and analyzed with a Trinocular microscope fitted with a light source at different magnifications. The above procedure is repeated for all collected samples to identify the diatom species anatomically under a microscope.

2.4 Microscopic examination

After the final centrifugation, the pellet was transferred to the slide with the help of a dropper, and a cover slip was placed on it. The microscopic slide was then set aside to air dry. Once the slide dried it was examined under a Trinocular microscope at magnifications of 10x, 40x, and 100x. The diatom species were identified based on their structural properties such as shape, symmetry, raphe and striae.

Table 1 : List of water bodies of salem taluk

S.no	Name of water body	Code	Temperature of water (at time of sampling)
1	Puthu Yeri	S1	33°
2	Puthur Agarharam Lake	S2	34°
3	Poolavari Lake	S3	31°
4	Kottanathan Lake	S4	30°
5	Erumapalayam Lake	S5	32°
6	Mookaneri Lake	S6	37°
7	Kumaragiri Lake	S7	31°
8	Selattampatti Yeri	S8	32°
9	Gajal Lake	S9	34°
10	Pnattamangalam Yeri	S10	33°

RESULTS AND DISCUSSION

In collected water samples from different lakes after extraction it was examined under Trinocular microscope and identified fifty four species of diatoms. As the water samples collected within the month of July and August with average water temperature of 30°, 31°, 32°, 33°, 34°, 37°. This temperature is very suitable for growth of diatoms.

Table 1: Diatoms of Puthu yeri

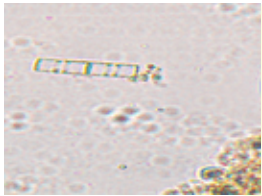
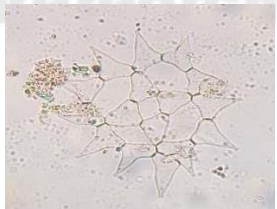
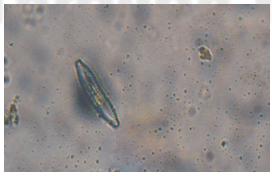
 Aulacoseira granulata	 Groenbladia neglecta	 Cylindrotheca closterium	 Navicula directa
 Gomphonema augur	 Pediatrum simplex var. duodenarium	 Hantzschia amphioxys	 Triceratium
 Nitzschia taylorii sp	 Sellaphora stroemii		

Table 2 : Diatoms of Puthur agraaharam lake

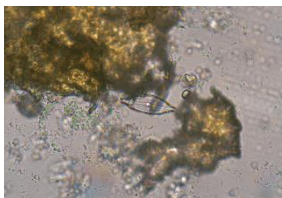
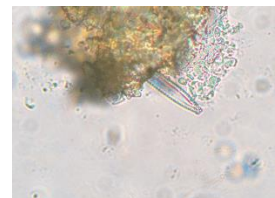
			
Anomoeoneis sphaerophora	Navicula sp	Nevicula thienemannii	Nitzschia supralitorea

Table 3 : Poolavari lake

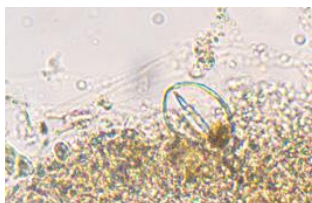
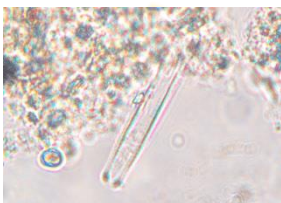
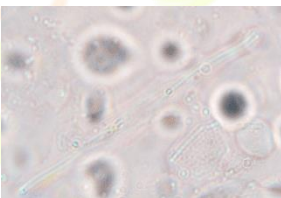
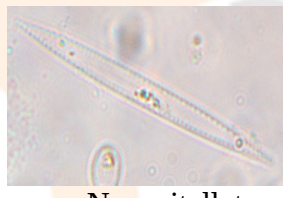
			
Cocconeis pediculus	Gomphonema gracile	Navicula subconcentrica	Navicula viridis
			
Nitzschia agnita hustedt	Nitzschia longissima	N. capitellata	

Table 4 : Kottanathan lake

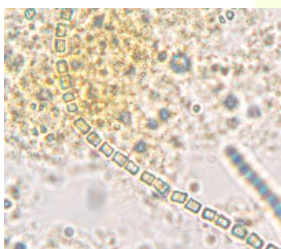
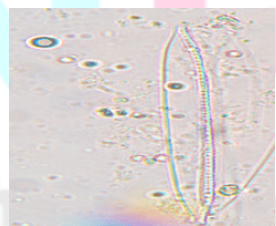
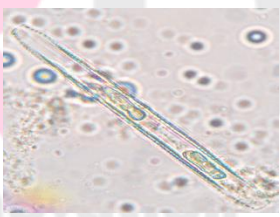
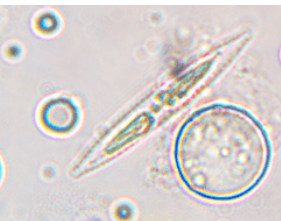
			
Melosira perpusilla	Nitzschia bizertensis	Nitzschia fonticola	Nitzschia linearis
			
Nitzschia gracilis			

Table 5 : Erumapalayam lake

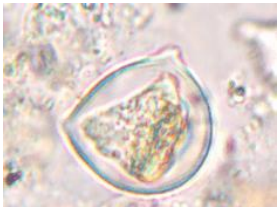
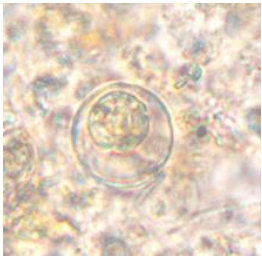
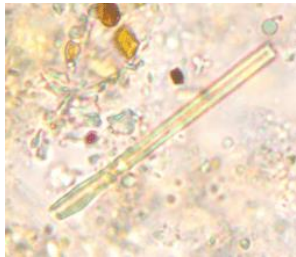
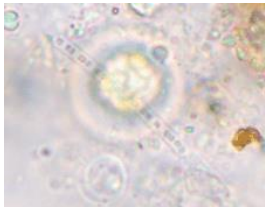
			
Melosira solid var. multiformis	Cyclotella sp	Eunotia valida	Leptocylindrus danicus

Table 6 : Mookaneri lake

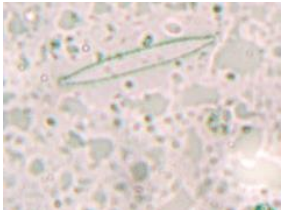
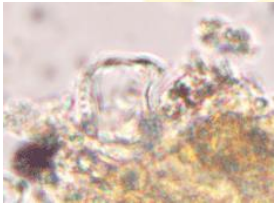
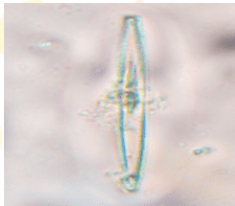
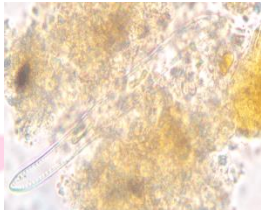
			
Nitzschia palea	Cyclotella quillensis	Synedra gracilis	Nitzschia obtusa

Table 7 : Kumaragiri lake

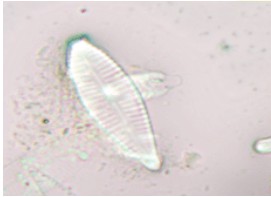
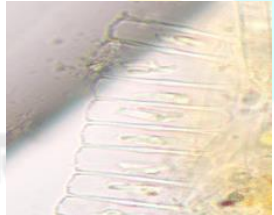
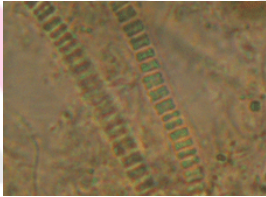
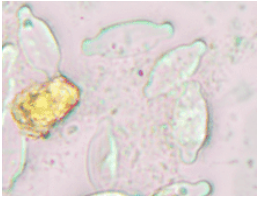
			
Achnanthes sp	Coscinodiscus locustis grun	Craticula cuspidate	Gomphonema gracile
			
Gomphonema lanceolatum	Diadesmis confervacea	Navicula cryptocephala	Melosira varians
			
Navicula gastrum			

Table 8 : Selatthampatti yeri

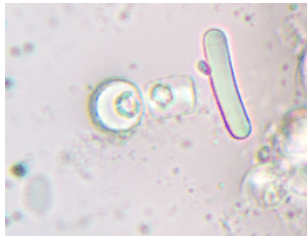
		
Eunotia flexulosa	Tryblionella hungarica	Navicula sp

Table 9 : Gajal lake

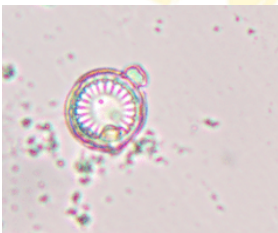
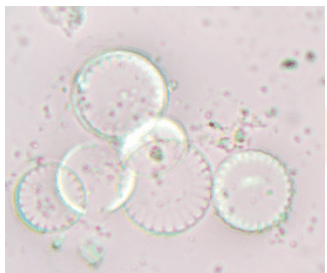
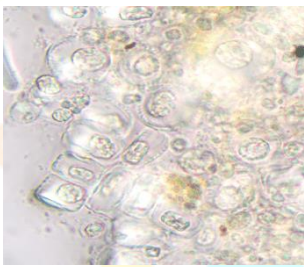
			
Navicula cuspidata	Stephanodiscus medius	Synedra ulna	Tabularia fasciculata

Table 10 : Pnattamangalam yeri

			
Cyclotella meneghiniana	Thalassiosira sp	Melosira sp	Nitzschia recta

Numerous number of diatom species were discovered in the collected water samples. Around fifty four species of diatom found on Salem taulk. Each water body exhibits a unique diversity in the distribution of diatoms. Some water bodies have site specific diatoms. Large numbers of species are belonging to the pinnate. The detail of the distribution of diatoms in different water bodies of Salem Taluk, SALEM, TAMILNADU are picturized. The diatomological study was conducted in various region of India for creating a data of diatoms i.e., Punjab, Delhi, Bhopal, Chhattisgarh. But the study was not conducted in Salem region.

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