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Diatoms Databank For Delhi, India: Forensic Identification of Diatoms Based on Morphology

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ABSTRACT

Diatoms are unicellular, photosynthesizing algae found in fresh and marine waters as well as in moist soil. This research aims to identify different diatoms present in different water bodies in Delhi region. The sample collection for this study was undertaken during January to March 2016 from 14 water bodies which includes eight lakes, three ponds, one river, one canal, and one well. All collected samples of

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diatoms from were then heat fixed individually and observed under microscope. Diatoms were then identified by analyzing their morphology. In total 117 diatoms, 7 morphological structure and 32 genera were identified. In order to link both the suspect and the victim with crime scene, morphological and genera based information of Diatoms and their Databank will facilitate to narrow down the selection of water bodies of a particular site. Hence, this research plays a vital role in forensic science as to endow with information and support in the investigation for drowning site.

Keywords: Diatoms, Morphology, Databank, Forensic Science

INTRODUCTION –

Diatoms, in algal community are especially useful in crime scene to link the suspects and victims to crime scenes in the region of fresh water.[**3]** Diatom species are effectively distinguished from the characteristic shape of the cells and special refractive design caused by the silica within the cell wall.[4]Seasonal and geological variety in diatom plenitude and differing qualities is utilized to create botanical profiles of aquatic environments which can at that point be compared to specimens collected from body tissues or other materials recovered from the scene of crime.[1] Diatom tests are routinely used for the analysis of drowning cases [5], and in evaluating the autopsy interim, or time since death .[2]

PURPOSE OF STUDY

During the recent years, identification of diatoms and their detection in crime exhibits are enormously used in criminal investigation by forensic science laboratory in India especially Haryana. The data on diatom from different geographical location is required to effectively solve crime cases. Various studies have been reported in this regards. However, from Delhi region there is hardly any studies that have been come across.

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This research aims to generate Data Bank of the different types of diatoms in different water bodies as a ready reference for use in forensic investigation.

MATERIALS AND METHODS

Sampling

The samples for study were collected during the month of January 2016-march 2016. Empty bottle was immersed 4 cm below the water level from the edge of the water body. Approximately 1 liter water was collected and then it was sealed properly with the cap.

Sample Preparation

- 500ml water was measured and then transferred to the beaker. 5ml lugol's iodine was added into the solution and after mixing it properly, the solution was left undisturbed overnight at room temperature, mixed properly and left overnight.

  (Lugol's Iodine method: -Chemicals: -Lugol's Iodine Solution-Iodine-2.54g, Potassium iodide-1.65g, Distilled water-30ml.)
- Next day, supernatant portion of the water was discarded and lower portion was poured into tarson tube and centrifuged at 3000rpm for 15 minutes.
- Again, upper portion was discarded, and more solution was added and centrifuged.
- This process was repeated for three times.
- The lower layer of solution was then used for slide preparation.
- The glass slide and cover slip were cleaned properly with the help of acetone or methanol.
- 2 drops from centrifuged water sample were placed on slide and covered with cover slip.

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- The slide was then gently heated on a hotplate until all liquid evaporated and slide got dried up.

Sample Observation

- The sample was viewed under microscope at 40X and further for better result the sample was also viewed at 100X by putting immersion oil on slide.
- Diatoms were observed and photographs of diatoms were taken with the help of camera.

RESULT AND DISCUSSION

In the present study, fourteen different types of water bodies were taken, which includes eight lakes, three ponds, one river, one canal, one well. All the water bodies showed different and diverse distribution of diatoms. At the time of sample collection which was done in between January to march 2016, the weather was almost same. So in this study a site specific diversification was found in occurrence of diatoms irrespective of weather condition.

Identification of Diatoms based on morphology has been conducted and then they were further categorized in their respective genera. Nine morphological categories of diatoms that have been studied are:

1. NITZSCHIOID

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Figure 1- They have valves with bilateral symmetry.Valves usually proportioned to both apical and Transapical axes. They have well developedraphid, and positioned near the periphery of valve.

2. CENTRIC

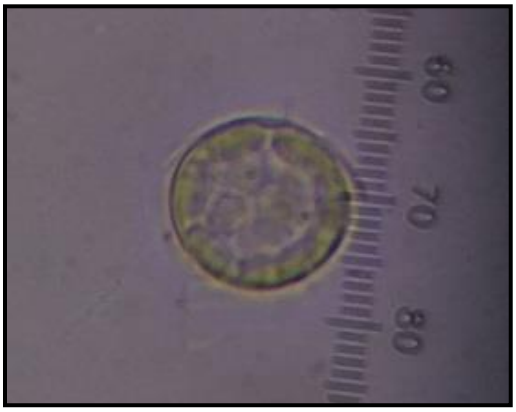

Figure 2- They have Radial symmetry valves. Raphe system is absent and thus immotile in nature.

3. ARAPHID

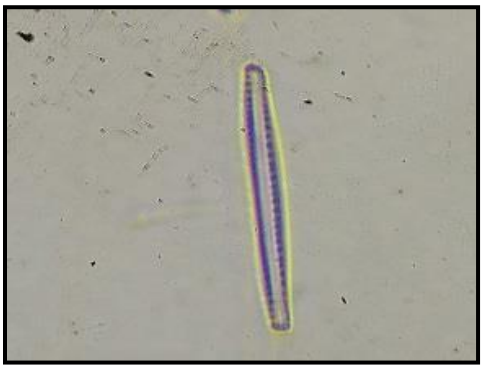

Figure 3- They have bilateral symmetry valves. Raphe system is absent and thus immotile in nature.

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4. SYMMETRICAL BIRAPHID :

Figure 4- They have bilateral symmetry valves.Valves are symmetrical to both axis i.e. apical and Trans apical. Raphe system is well developed and as a result cells are highly motile. This is the most diverse groupamongst the freshwater diatoms.

5. MONORAPHID

   They have bilateral symmetry valves. Raphe system is present on one valve whereas absent on another one.

   No as such diatom identified in any of the water body.

6. EPITHEMIOID-They have bilateral symmetry valves. Valves asymmetrical to apical axis. Raphe framework is well developed and encased inside a canal. Raphe framework situated close the periphery of valve.

   No as such diatom identified in any of the water body.

7. ASYMMETRICAL BIRAPHID

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Figure 5- They have asymmetrical valves to either apical axis or the Transapical axis, or both. Raphe system is fully developed.

8. SURIRELLOID

Figure 6- They Valves with bilateral symmetry. Raphe system is fully developed and surrounded by a canal. Raphe aligned around the entire periphery of valve.

9. EUNOTIOID

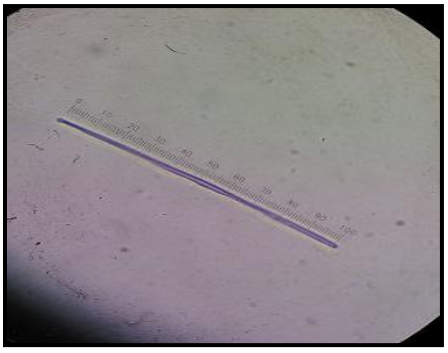

Figure 7- They have valves with bilateral symmetry and generally valves are deviated from the apical axis. Raphe framework is brief and hence gives frail motility Raphe located on valve, mantle and face.

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Table 1: Samples arranged into 9 morphological categories of Diatoms

Types of Morphologies									
Sample no.	Nitzschioid	Centric	Araphid	Symmetrical biraphid	Monoraphid	Asymmetrical Biraphid	Surirelloid	epithemioid	Eunotioid
1			✓						
2	✓	✓	✓	✓		✓			
3	✓	✓	✓	✓					
4	✓	✓	✓						✓
5		✓							
6	✓	✓	✓	✓					
7	✓	✓		✓					
8		✓	✓	✓			✓		
9			✓	✓			✓		
10	✓		✓	✓		✓			
11		✓	✓	✓		✓			✓
12	✓	✓	✓	✓					
13		✓	✓	✓		✓			
14			✓	✓					

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Table 2:**List of Samples along with their genera level of Diatoms identified among them**

SAMPLE NO.	GENERA
1.	Synedra
2.	Reimeria , Nitzschia , Cyclotella , Ellerbeckia,Cylindrotheca,Cymbellonitzschia,Caloneis,Diatomella,Navicula,Melosira
3.	Nitzschia, Cyclotella,Haslea,Urosolenia ,Chaetoceros, Navicula,Asterionella
4.	Cylindrotheca, Eunotia,Tabularia, Cyclotella, Synedra, Nitzschia, Melosira, Orthoseira
5.	Melosira, Ellerbeckia
6.	Navicula,Craticula, Haslea, Fragilaria, Nitzschia,Diatomella, Actinocyclus, Tabularia
7.	Haslea, Navicula, Denticula, Cyclotella, Diatomella,Stephanodiscu,Sellaphora
8.	Actinocyclus, Haslea,, Cyclotella, Surirella,Nupela ,Stephanodiscus , Asterionella
9.	Fragilaria, Synedra, Haslea,Stenopterobia ,Tabellaria Navicula,
10.	Distrionella,Nitzschia, Nupela , Reimeria, Tabularia
11.	Diatoma, Eunotia, Actinocyclus, Synedra, Pinnularia ,Nupela, Tabularia ,Stephanodiscus, Entomoneis, Urosolenia , Fragilaria
12.	Navicula, Melsoira, Nitzschia,Stephanodiscus, Diatomella , Ellerbeckia, Fragilaria

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13.	Fragilaria ,Navicula, Cyclotella, Amphora
14.	Diatoma, Navicula

As shown in Table 1,7 morphologies of diatoms found in samples that has been identified in this study were Centric, Asymmetrical Biraphid, Symmetrical Biraphid, Nitzschioid, Surireloid, Eunotioid and Araphid.

Nitzschioid, Centric, Araphid ,symmetrical biraphid morphologies are present in almost all samples whereas Asymmetrical Biraphid, Eunotioid &Surireloid morphology are present in 2-3 samples only.

As shown in Table 2 ,Diatom genera which were found in the water bodies of Delhi region majorly belongs to Cyclotella, Diatomella ,Fragilaria, Haslea&navicula. The diatoms that are site specific are Amphora,Caloneis,Cymbellonitzschia,Denticula, Chaetoceros, Craticula, Distrionella,Entomoneis, Orthoseira ,Pinnularia ,Sellaphora,Stenopterobia ,Surirella,Tabellaria .

CONCLUSION-

A total of 117 diatoms were found in all the water samples taken from 14 water bodies and identified based on their morphological category. Out of 9 morphological based categories of Diatoms, 2 types of morphology were not present in any of the samples namely, epithemioidand monoraphid. They werefurther categorized into genera level to narrow down the selection of water bodies of a particular site. 32 different genera of diatoms were identified. Of which 14 genera namely Amphora, Caloneis, Cymbellonitzschia, Denticula, Chaetoceros, Craticula,

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Distrionella, Entomoneis, Orthoseira, Pinnularia, Sellaphora, Stenopterobia,Surirella&Tabellaria, are found to be site specific. They are identified by "Identification Guide and Ecological Resource for Diatoms of the United States" a comprehensive Atlas/ key for diatom identification and also cross-checked by an expert. A link can be established between the alleged drowning medium and the drowned victim by the diatoms discovered in water. Thus Diatoms databank acts as resulting helpful resource in doubtful drowning cases, especially when the morphologies of diatoms are site specific.

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