

■ ORIGINAL ARTICLE

# Diatomological Mapping of Water Bodies of Villages of Karnal, Haryana

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## ABSTRACT

**Context:** Diatoms are unicellular, photosynthesizing algae phytoplankton; they are single-celled aquatic algae. Diatoms are one of the largest group of organisms on earth and are found in different shapes and sizes, but diatoms are easily decipherable due to a unique its cell wall structure. The cell walls possess a characteristic silica coating, which is resistant to decay. It helps them maintain their shapes as it contains a large amount of brittle but hard silica, which is hydrated ( $\text{SiO}_2\text{H}_2\text{O}$ ) and noncrystalline. Diatoms have about 200 genera and 1,00,000 species differing in their structure. Diatoms are found at well-lit places as well as in moist conditions. Hence, they perform photosynthesis. Their small size helps them to penetrate human tissue and hence the forensic significance. Particularly in forensic science diatoms help in identifying the drowned dead body of a person and to distinguish between anti-mortem and post-mortem drowning.

**Aim:** The present study aims to identify the species of diatoms in different water bodies of Karnal (villages) and to identify the species which are site-specific and are found in a specific water body. The positive identification of site specific diatoms will help us to estimate the site of submersion in case of drowning deaths.

**Materials & Method:** In the present study we examined diatoms in water bodies located in the villages of Karnal district of Haryana. For this study we collected water samples from 7 different water bodies including canals, rivers, ponds, lakes, and borewells. The samples were centrifuged and diatoms were concentrated. Microscopic slides were prepared and observed under compound microscope at 100X magnification. Diatoms were inspected for their morphological types and for mapping purposes.

**Results:** Various diatom species including *Actinocyclus* sp., *Cocconeis* sp., *Rhoicosphenia* sp., among others were recovered. Some diatoms were found to be site-specific and others found to be common in all water bodies.

KEYWORDS | diatom mapping, villages, haryana, drowning cases, forensic investigation

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## INTRODUCTION

**D**ROWNING IS A FORM OF MECHANICAL asphyxia caused by inspiration of fluid into respiratory tract due to submersion of body (nose and mouth) into water or liquid.<sup>4</sup> When a dead body is recovered from water, there arises a question whether the person was alive or dead before entering the water

body. And here lies the importance of the diatoms. The principle behind the diatom test is that diatoms are present in every water body. Diatoms are used to differentiate between ante-mortem and post mortem drowning. If the person had entered the water body while he was still alive and the respiratory system was

functional which lead to the entry of diatoms into the lungs of the person. These diatoms then travel to the distant organs of the body like brain, kidney, bones etc with the flow of blood pumped by the heart.<sup>3</sup> While in case of post-mortem drowning, the person is already dead before entering the water source. Hence prevents the entry of diatoms to the distant organs. On the other hand the decree on tracing accurate place of drowning is an important part of medico-legal investigation. The question about the place of drowning arises when the true drowning tookplace is not clear. Usually, when a dead body rises from the bottom of water source to the surface, it will be seen near to the site where it had actually drowned but water current may soon carry the body to some other place from the original place of drowning. Forensic diatom testing plays an crucial role in the comparison of diatoms isolated from dead body and collected reference water samples to establish whether drowning was the cause of death or not and in establishing the precise site of drowning.<sup>2</sup>

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#### MATERIALS AND METHOD

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**Haryana:** Haryana is a state in northern India that separated from Punjab on 1st November, 1966. Haryana is surrounded by five states namely Punjab, Rajasthan, Himachal Pradesh, Uttar Pradesh and Delhi.<sup>1</sup>

**Karnal:** Karnal is a part of the National Capital Region (NCR) and situated in the north-central part of Haryana and is the administrative headquarters of Karnal district.

**Geographical Area and Location:** Karnal is covering an area of 2,471sq.km. The district covers 5.69% area of the state. Karnal District is bordered by Kurukshetra, Jind & Kaithal, Panipat.

**Physiographic Divisions:** Karnal is a part of Indo-Gangetic plains and is irrigated by a network of Yamuna canals. The district is divided into three regions namely: Khadar,

Bangar and Nadrak. The Khadar region are a low-lying river plains lying next to the river. Bangar lies next to Khaddar. Nadrak region lies beyond, with saline water.

#### Collection of Water Samples:

We collected water samples from 7 different freshwater bodies of villages of Karnal namely Pakka Pull, Karan Tal, Karan Lake, Yamuna river, Atal Park, Kalampura village and Gagsina village. A leak-proof plastic bottle was immersed to the maximum possible depth with its mouth opened. Then, the bottle was dipped in water so that water can enter in it. When the bottle was filled up to the neck it was taken out and closed tightly. The containers were marked and numbers were allotted along with all the relevant details. We collected samples in the month of August 2020.

**Laboratory analysis:** The present study was conducted in the Biology Division of Forensic Science Laboratory, Madhuban, Karnal (Haryana), India. Centrifugation machine, compound microscope, hot plate were used.

**Treatment of water sample:** After taking the sample to the laboratory the bottles were kept undisturbed overnight so that diatoms in water sediment at the base of the bottle (being heavier). On the next day, approximately half of the water from supernatant of the bottles were discarded and samples left were mixed well. Clean and sterile beakers were used for the analysis.

#### Isolation of diatoms:

Clean and sterile beakers, droppers, centrifuge tubes were used to avoid the chances of contamination of the samples. Water samples were then poured into cleaned micro centrifuge tubes (50ml). These tubes were labeled accordingly. The samples were then centrifuged at 2800rpm for 10 minutes. The supernatant was then discarded and the remaining sample was added with water from respective beakers and centrifuged again for 10 minutes at 2800 rpm. The process was repeated 3 times: discard supernatant, add more sample, centrifuge.

| SAMPLE NO. | PLACE OF COLLECTION    | DATE AND TIME PF COLLECTION | TYPE OF WATER SOURCE | VOLUME OF WATER COLLECTED |
|------------|------------------------|-----------------------------|----------------------|---------------------------|
| 1          | Pakka pull, (Madhuban) | 18 Aug 2020 (2:10 am)       | River                | 1 lt.                     |
| 2          | Kalampura Village      | 20 Aug 2020 (8:20am)        | Canal                | 1 lt.                     |
| 3          | Gagsina Village        | 21 Aug 2020 (7:30 am)       | Pond                 | 1 lt.                     |
| 4          | Karan Park             | 21 Aug 2020 (8:20 am)       | Pond                 | 1 lt.                     |
| 5          | Yamuna River           | 23 Aug 2020 (6:15 am)       | River                | 1 lt.                     |
| 6          | Atal Park              | 25 Aug 2020 (6:30 am)       | Pond                 | 1 lt.                     |
| 7          | Karan Lake             | 25 Aug 2020 (5:30 am)       | Lake                 | 1 lt.                     |

Table 1: Sources of water samples

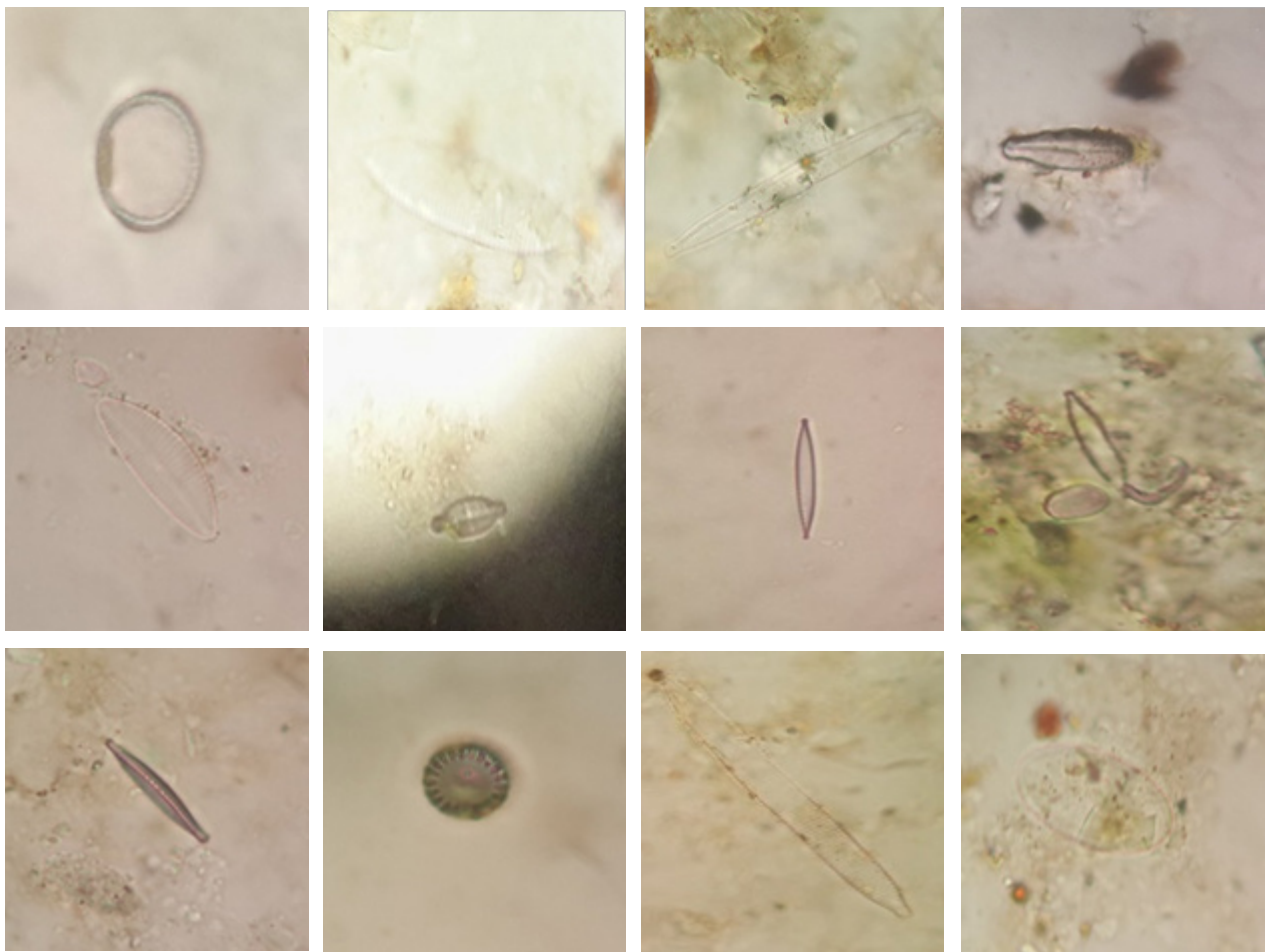
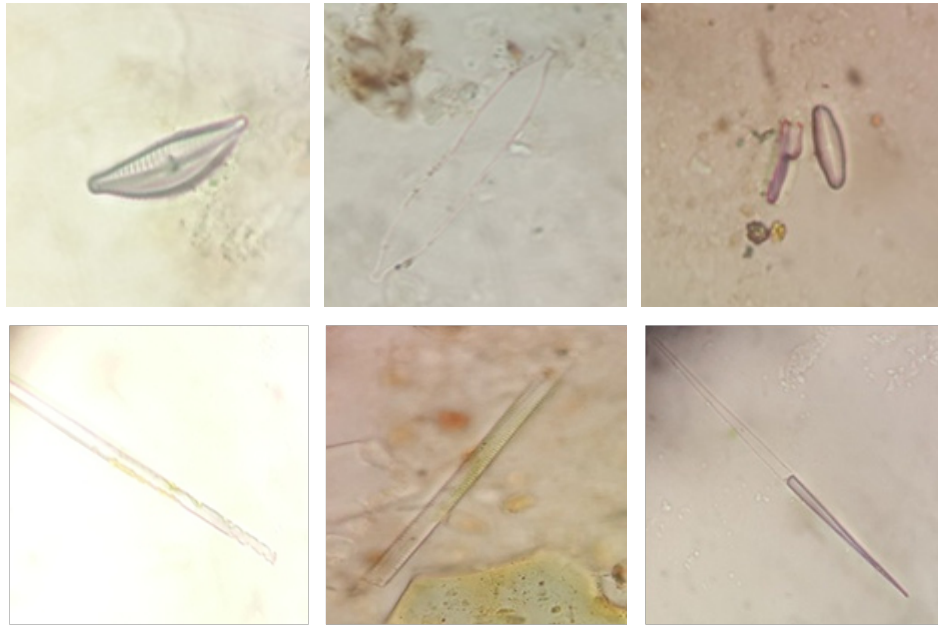


Figure 1: Microscopic view of Diatom species under compound microscope at 100X magnification from left to right - Actinocyclus sp.; Cocconeis sp.; Rhoicosphenia sp.; Opephorepacificca sp.; Cymbella sp.; Placoneis elginensis; Nitzschia sp.; Eucampia sp.; Rhoicosphenia sp.; Cyclotella sp.; Navicula viridula; Coconeis peduculus; Cymbella tumida; Rhoicosphenia sp.; Sallaphora popul.



**Figure 2:** Microscopic view of diatom species which remained unidentified under compound microscope at 100X magnification.

At last, the supernatant was discarded and sediment pellet were used for preparing slides.

#### **Preparation of Slides:**

A drop of sediment from base of the tube was placed on cleaned microscopic slide. The slide was placed on a hot plate at 1000 C for 1-2 minutes to remove the extra moisture and then cooled at room temperature and mounted with DPX and cover slip. A drop of oil was placed on the slide and slides were examined at 100X (oil immersion) magnification. Each slide was thoroughly examined.

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#### **RESULTS**

In the present study 7 water samples were analyzed and different species of diatoms were observed. Some of the species found were common in all 7 water bodies under study and some are common in a few water bodies while others are site-specific as found in the present study.

The results of present study revealed diatoms of *Actinocyclus sp.*; *Cocconeis sp.*; *Rhoicosphenia*

*sp.*; *Opephorepacificca sp.*; *Cymbella sp.*; *Placoneis elginensis*; *Nitzschia sp.*; *Eucampia sp.*; *Rhoicosphenia sp.*; *Cyclotella sp.*; *Navicula viridula*; *Coconeis peduculus*; *Cymbella tumida*; *Rhoicosphenia sp.*; *Sallaphora popul.* Many of diatoms are found to be common in all water samples while others are found to be site-specific.

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#### **DISCUSSION**

As shown in the results, the species of diatoms discovered through the present study varies from one water body to another which was supported by earlier studies (Vandna V 2012, 2013). It was also found that diatoms in lake waters were different from diatoms of the canal and other water bodies. In lake waters (sample 7) both of the diatoms discovered belonged to order centrales while the diatoms discovered in park water (sample 6) belonged to order pennales. Mixed type of diatom flora is found in other water bodies (sample 1,2,3, and 5). Diatoms of *Cymbella sp.*; *Navicula sp.*;

*Nitzschia sp.* were commonly found in sample 1, 2, and 3. While the diatoms of other species i.e. *Stephanocyclus sp.*, *Actinocyclus sp.*, *Eucampia sp.*, *Rhoicosphenia sp.* were found to be site-specific.

It was also observed that in water bodies examined that a majority of diatoms discovered belonged to order pinnate and some to centrales. Pennates diatoms include *Peronia sp.*; *Naviculavirdula*; *Cymbellatunida*; *Rhoicosphenia sp.*; *Nitzschia sp.* While *Actinocyclus sp.*; *Stephanocyclus sp.*; *Cyclotella sp.* belonged to order centrales. This study was made in the summer season hence many other species can be found depending on the weather conditions and temperature.

Four diatoms remained unidentified, these unidentified diatoms in present study further increases the range of diatomological studies in water bodies of Haryana and also in different seasons.

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#### CONCLUSION

From the findings of this study, it could be stated that many of diatom species are site specific and a database made from these findings is a valuable tool in tracing the exact place of drowning cases and can assist in legal investigation. Diatoms can be extracted from the body of the deceased and can be identified with the water sample in

which the body was discovered. This can help in determining antemortem and post mortem drowning and to find out the primary and secondary crime scene. This approach will help in reconstruction of the crime scene and events. There is a need to further carry out such studies in other water bodies in different season to build up a data base of diatoms. **IJFMP**

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