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Forensic Study of Diatoms Distribution in Gomti River, Lucknow and Effect of Seasonal Variation on Diatomological Mapping

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ABSTRACT

Diatoms are regarded as valuable evidence to correlate the cause of death. In the present study, 17 water samples were collected from different sites of Gomti river ghats of Lucknow and Jaunpur district. On the basis of this examination, different genera were identified in which diatom genera like Bacillaria, Cyclotella, Navicula, Cymbella and Nitzschia were found to be common among all sites tested. The frequency distributions of diatoms in winters were found to be more prevalent as compared to summer samples. The diatom genera like Melosira, Clonies, Nupela Ropolodio, Chateceros and Entomonesis were found to be site-specific. The data would be valuable for the site characterization by comparison of diatoms between the water sample of drowning site and the viscera of corpse recovered.

Key words : Forensic sciences, drowning cases, diatoms, microscopic techniques, forensic botany

INTRODUCTION

The Gomti (also termed as Gumti) river is a tributary of the Ganges. The Gomti, a monsoon and ground, water-fed river, originates from the Gomat Taal near madho tanda, Pilibhit, Uttar Pradesh, India. It extends 960 kilometres (600 miles) through Uttar Pradesh and meets the Ganges near Saidpur, kaithi, 27 kilometres (17 mi) from Varanasi district. It meets a small river, the Gaihaaee, 20 kilometres (12 mi) from its origin. A major tributary is the Sai river, which joins the Gomti near Jaunpur district. The Markandey mahadeo temple is at the confluence of the Gomti, and the Ganges (Sharma *et al.*, 2018; Vinayak and Gautam, 2019; Jiank *et al.*, 2020). Diatoms analysis is a valuable tool in forensic science and it plays a vital role in diagnosis of drowning cases. The basic principle of diatoms test in drowning is based on correlation between diatoms present in the medium where the possible drowning took place. Presence of diatoms in the biological sample, serve as an indicator of drowning proving that such microorganism, is directly related with the temperature, light intensity, pH and physio-chemical characteristics of the environment (Zhao *et al.*, 2015; Thakar *et al.*, 2018; Luthra *et al.*, 2019; Deng *et al.,* 2021; Deng *et al.*, 2022). In the present study, attempt was made to study species diversity and distribution of diatoms in Gomti river of Lucknow and Jaunpur district and secondly to study the effect of seasonal variation on distribution of diatoms in water collected in summer and winter seasons.

MATERIALS AND METHODS

The water samples of Gomti river were collected during the months of January-April in 34 water plastic bottles from Jaunpur and Lucknow districts. Before the samples were collected in the bottle, the floor of the water bodies was disturbed so that more amount of mud enters the bottle thereby increasing the number of diatoms in the sample. Two hundred ml water sample was collected in plastic bottles from each 10 Ghats : Achala Devi Ghats, Balua Ghats, Gular Ghats, Akhado Ghats, Sooraj Ghats, Ram Ghats, Viserjan Ghats, Santoshi Ghats, Kirabeer Ghats and Shiv Gopal Ghat from district Jaunpur, and seven water samples were collected from each Ghat : Pipri Ghats, Kala Kotahi Ghats, Panchwati Ghats, Shukla Ghats, Lallumal Ghat, Rastogi Ghats, Bade Hanuman Ghats from district Lucknow. The water sample (approximately 10 ml) from the bottom of the bottle was collected using dropper and was transferred in 1.5 ml vials. The sample was then digested by adding 2 ml of concentrated nitric acid, pinch of potassium dichromate and incubated overnight at room

temperature. The samples were centrifuged at 3000 rpm for 5 min. The supernatant was decanted and replaced with distilled water. The sample was made transparent by vortexing it at 3000 rpm for 3 min. The water sample was centrifuged two or three times to obtain maximum pellets in Tarson tube.

After washing of pellets amount, it was transferred on the microscopic slide by the help of dropper. These microscopic slides were kept on slide warmer plate at 30-40 ^{0}C for 5-8 min for drying. Added 1 drop of DPX upon the slides and the cover slip was placed. The slides were put in the hot oven for 1 h. The cleaned materials were used for preparation of slides and examined under stereo-microscope at different magnification such as 20x, 45x and 100x. Microscopic slides were observed with LB-237 Binocular Biological Digital Microscope with Phase Contrast Kit. Wide Field, Semi-Plan Optical System and Camera and Software (1.3MP) PRO HDMI LABOMED light microscopes equipped with differential interference contrast and 1.25 NA objectives. Digital images were taken with a 1.3 MP CMOS digital camera.

RESULTS AND DISCUSSION

Only 14 types of diatom strands were found in the water samples of the study area. It was observed that in the month of January the concentration of diatoms in water samples was more than that in the month of April. It was also observed in the previous study that species diversity was increased in richness in number of species and data related to diatoms growth also revealed that diatom growth was more in winters then the rainy and summer season (Pal *et al.*, 2017). This study will help in establishing diatom logical maps of water bodies for supporting forensic investigations. According to the previous study on diatom logical mapping of water bodies, it was proved that in case of no water sample reference was available during identification of site of water body in that case; one can prove it through the diatom logical maps (Kaur *et al.*, 2018).

Frequency of diatoms genera found on different ghats of Gomti river at Jaunpur district is given in Fig. 1 and in ghats of Lucknow is given in Fig. 2. Major diatom genera identified at different sites were :

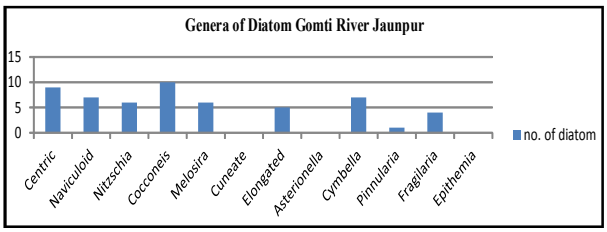

Fig. 1. Showing frequency distribution of diatoms of Gomti river, Jaunpur district.

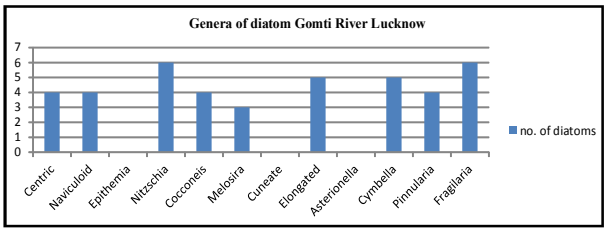

Fig. 2. Showing frequency distribution of diatoms of Gomti river, Lucknow district.

Aneumastus, Cocconeis and Cyclotella.

Ram Ghat : Achnanthes, Caloneis, Pinnularia, Cocconeis and Cyclotella.

Viserjan Ghat : Bacillaria, Cocconeis, Melosera and Nupela.

Balua Ghat : Achnanthes, Aneumastus, Cocconeis, Cyclotella and Sollophora.

Gular Ghat : Cocconeis, Cyclotella, Nitzschia and Stephnocyclus

Sooraj Ghat : Bacillaria, Cocconeis, Cymbella, Cyclotella, Fragilaria, Geissleria, Nitzschia and Surriella.

Kirabeer Ghat : Coconeis, Nitzschia, Nupela, Achnanthidium, Pinnularia, Surriella and Stephanocyclus.

Bade Hanuman Ghat : Bacillaria, Fallaciala, Stephanocyclus, Achnanthes, Nitzschia, Cocconeis and Bacillaria.

Shiv Gopal Ghat : Chnanthes, Aneumastus, Tribllonella, Syendra, Cocconeis and Fragillariforma.

CONCLUSION

The site specific diatoms were identified from Gomti river, Uttar Pradesh. The diatom genera like Melosira Colonies, Nupela Ropolodio,

Chateceros and Entomonesis were found to be site-specific. During the study, it was observed that frequency distribution of diatoms changed with seasonal factors which should be explored further. In winters, the frequency of diatoms was found to be more in numbers as compared to summer samples.

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