



## DIATOM FLORA OF RAJASTHAN: A REVIEW

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Diatoms are eukaryotic single-celled photosynthesizing algae that have significant ecological and forensic importance. They inhabit practically every aquatic environment, including fresh and salt water bodies they have a siliceous skeleton (frustule). In this review, the diatom reported from water bodies of Rajasthan compiled. This review revealed that the most common diatoms reported in the water bodies of Rajasthan are *Navicula*, *Nitzschia*, *Cyclotella*, *Synedra*, *Fragilaria* and *Gomphonema*, whereas some site specific diatom's species are also reported like *Stauroneis* in Kaylana lake of Jodhpur, *Brachysira* in Chambal river, Kota, *Achnanthisidium* in Chambal river, Kota and Maavatha pond (Amer fort) and *Anomoene is* from Indira Gandhi Canal, Hanumangarh.

**Keywords:** Diatoms, Phytoplankton, Rajasthan, Siliceous skeleton and Water bodies.

### Introduction

Diatoms are a member of the diverse class of aquatic microscopic organisms known as algae. They can be found in almost every aquatic or moist habitat, including rivers, wet rock walls, oceans and ice. Individual silica shells on these aquatic organisms act as simple glass homes that allow light to flow through for the production of energy through carbon fixation during photosynthesis. Diatoms are extremely prevalent and are crucial to the synthesis of raw materials on a worldwide scale. According to Tréguer et al. diatoms are thought to be responsible for 43% of the primary production in the oceans and 25% of the oxygen in the atmosphere<sup>1</sup>.

There are currently between 25,000 and 30,000 different species of diatom known. Numerous new species have reportedly been discovered, and it is thought that more than 200,000 diatom taxa remain in existence worldwide<sup>2,3</sup>. There are thought to be 14,700 different taxa of diatoms throughout the Indian subcontinent, including freshwater, brackish, and marine varieties.

There are number of studies on diatoms of India. Gonzalves in 1947 was most likely the first to documents

Maharashtra's diatoms. The diatoms of Bombay were described in details by Gonzalves and Gandhi<sup>4</sup>. The contribution of India's fresh water diatoms was made by Singh et al<sup>5</sup> and Kumar and Singh<sup>6</sup>.

Gandhi<sup>7</sup> conducted the initial study on Pratapgarh, Rajasthan's freshwater diatoms. A studies done by Pareek et al.<sup>8</sup>, Singh et al.<sup>5</sup> and Gandhi<sup>9</sup> revealed the presence of 22 genera and 35 diatom species in Mansagar Lake of Jaipur and 24 diatom species in Galta Kund in Jaipur, Rajasthan.

Numbers of studies have been done on diatoms species in Rajasthan by different researchers. However, relatively few results are significant from a forensic perspective and more work is done in limnological and phytoplanktonic research to evaluate the water quality index and for ecology studies.

The very first attempt to study diatoms in Rajasthan was done by Gandhi<sup>9</sup> in the adjacent ditches and ponds of the town, he discovered species of *Cyclotella*, *Synedra*, *Eunotia*, *Caloneis*, *Navicula*, *Pinnularia*, *Amphora*, *Neidium*, *Cymbella*, *Gomphonema*, *Nitzschia*, *Hantzschia*, and *Surirella* in the Pratapgarh district of Rajasthan, Later in order to explore the

planktonic variety of the holy lake of Pushkar, Khanna and Yadav<sup>10</sup> reported species of *Melosira*, *Nitzschia*, *Navicula*, and *Surirella*. *Eunotia*, *Nitzschia*, *Rhopalodia*, and *Hantzschia* were found to be the predominant diatom species in the freshwater bodies in the dry region of Rajasthan (Jaisalmer, Jodhpur, Bikaner and Churu) according to recent research on the algal biodiversity of the region<sup>11</sup>. Singh<sup>5</sup> performed research on three of Jaipur's major water bodies and found that *Synedra*, *Melosira*, *Rhoicosphenia* and *Cyclotella* diatoms are common in Galta kund, which flows from one side to the other, but only *Cyclotella* predominates in Mansagar lake because it is heavily polluted and stagnant.

A great variety of diatoms including *Navicula*, *Geisselaria*, *Achnantheidium*, *Nitzschia*, etc. was found in Mavatha a seasonal pond in Amer, Jaipur, Rajasthan<sup>5</sup>. Barupal and Meghwal<sup>12</sup> reported species of *Amphora*, *Navicula*, *Gyrosigma*, *Diadesmis*, *Gomphonema*, *Cymbella*, *Achanthes*, *Cocconies*, *Fragilaria*, *Synedra*, *Ctenophora*, *Nitzschia*, and *Cyclotella* in a collaborative study on 10 ponds in Churu. Two separate studies on the Chambal River were conducted by Grover et al. (2017)<sup>13</sup> and Srivastava et al. (2017)<sup>14</sup>, they reported the presence of the species *Navicula*,

*Cyclotella*, *Cymbella*, *Rhopalodia*, *Melosira*, and *Gomphonema*. More species, including *Achnantheidium*, *Cocconies*, *Caloneis*, *Amphora*, *Nitzschia*, *Brachysira*, *Neidium*, *Sellaphora*, and *Hantzschia*, were reported by Grover et al.<sup>13</sup> and Narayan et al.<sup>15</sup> from the Chambal river.

The general species observed are *Navicula*, *Nitzschia*, *Synedra*, *Gomphonema*, *Fragilaria* & *Cyclotella*. *Navicula* is a species prevalent in all water bodies with the exception of Kunda reservoir in Bharatpur and the reservoirs in the desert region of Rajasthan (Jaisalmer, Jodhpur, Churu, and Bikaner). *Brachysira* is a species of diatom of the order Navicules that is exclusive to the Chambal river alone<sup>13</sup>. Only two locations are known to contain the *Achnantheidium* species: Maavath in Jaipur and the Chambal river in Kota<sup>13</sup>. The diatoms known as stauronies are found in northern rocks where the pH ranges from slightly acidic to nearly neutral. In Rajasthan, they are particularly abundant in the lentic Kaylana Lake in Jodhpur<sup>15</sup>. It typically grows in brackish water, indicating that the Indira Gandhi Canal has salinity higher than freshwater but not higher than sea<sup>6</sup>. This canal has salinity more than freshwater but not higher than sea.

**Table 1.** Diatom flora of Rajasthan.

S. No.	Name of the species	Habitat
1.	<i>Achnantheidium minutissium</i> <i>Achnantheidium sibiricum</i>	Pools and ditches surrounding the town Mavaatha Jaigarh fort (Jaipur) <sup>8</sup>
2.	<i>Achnanthes andicola</i> <i>Achnanthes exigua</i>	Galta Kund (Jaipur) <sup>8</sup> Chambal river (Kota) <sup>13</sup> .
3.	<i>Amnoseia sp.</i>	Chambal river (Kota) <sup>13</sup> .
4.	<i>Amphora ovali</i>	Pichola lake (Udaipur) <sup>16</sup> , Galta kund (Jaipur) <sup>8</sup> Kishore Sagar (Kota) <sup>17</sup> .
5.	<i>Anomoeneis sphaerophora</i>	Indira Gandhi Canal, Ghaggar river, (Hanumangarh) <sup>6</sup> .
6.	<i>Bacillaria paxillifera</i>	Pichola lake, (Udaipur) <sup>16</sup> .
7.	<i>Brachysira brebissonii</i> <i>Brachysira zellensis</i> <i>Brachysira seriens</i> <i>Brachysira styriaca</i> <i>Brachysira follies</i>	Chambal river, (Kota) <sup>13</sup> .
8.	<i>Caloneis bacillum</i>	Kishore Sagar, (Kota) <sup>17</sup> ,

	<i>Caloneis beccariana</i>	Kaylana Lake, (Jodhpur) <sup>15</sup> , Chambal river (Kota) <sup>13</sup> .
9.	<i>Cocconeis pediculus</i> <i>Cocconeis placentula</i>	Kishore Sagar (Kota) <sup>17</sup> , Gang Canal (Sri Ganganagar) <sup>18</sup> , Kaylana Lake (Jodhpur) <sup>15</sup> , Chambal river (Kota <sup>13</sup> , Sawai Madhopur <sup>19</sup> ), Ponds - Fatehpuria pond, Sethani Johada, Pithana Johada, Droun pond, Manaksar pond, Natho pond, Talchhapar pond, Chadwas Pond, Parmana pond, Girdhar pond (Churu) <sup>12</sup> , Kaylana Lake (Jodhpur) <sup>15</sup> .
10.	<i>Coscino discus</i>	Galta Kund, Mavaath lake (Jaipur) <sup>8</sup> Indira Gandhi Canal (Ghaggar river, Hanumangarh) <sup>6</sup> .
11.	<i>Ctenophora pulchella</i>	Kaylana Lake (Jodhpur) <sup>15</sup> .
12.	<i>Cyclostephanos dubius</i>	Chambal river (Kota) <sup>13</sup> .
13.	<i>Cyclotella comta</i> <i>Cyclotella kutzingiana</i>	Kund reservoir - open pond (Bharatpur) <sup>20</sup> .
14.	<i>Cyclotella meneghiniana</i> <i>Cyclotella striata</i>	Surrounding ponds and ditches (Pratapgarh) <sup>9</sup> , Galta kund (Jaipur) <sup>8</sup> Pichola lake <sup>16</sup> , Jaisamand lake (Udaipur) <sup>21</sup> Chambal river (Kota) <sup>13</sup> , Gang Canal (Sri Ganganagar) <sup>18</sup> .
15.	<i>Cymbella rupicola</i> <i>Cymbella turgid</i> <i>Cymbella veniricosa</i> <i>Cymbella aspera</i>	Kishore Sagar <sup>17</sup> , Chambal river (Kota) <sup>13</sup> , Pichola lake <sup>16</sup> , Jaisamand lake (Udaipur) <sup>21</sup> , Gang Canal (Sri Ganganagar) <sup>18</sup> .
16.	<i>Diadmesmis confervacea</i>	Kaylana Lake (Jodhpur) <sup>15</sup> .
17.	<i>Eunotia minor</i> <i>Eunotia pectinalis</i> <i>Eunita valida</i> <i>Eunita implicate</i>	Pools and ditches surrounding the town (Pratapgarh) <sup>9</sup> .
18.	<i>Fragilaria intermedia</i>	Kishore Sagar <sup>17</sup> , Chambal river (Kota) <sup>13</sup> , Galta Kund, Mavatha lake (Jaipur) <sup>8</sup> Pichola lake <sup>16</sup> , Jaisamand lake (Udaipur) <sup>21</sup> , Gang Canal (Sri Ganganagar) <sup>18</sup> , Kaylana Lake (Jodhpur) <sup>15</sup> , Ghaggar river, Indira Gandhi Canal - Ghaggar river (Hanumangarh) <sup>6</sup> .
19.	<i>Frustulia capucia</i> <i>Frustulia jogensis</i>	Pools and ditches surrounding the town (Pratapgarh) <sup>9</sup> .
20.	<i>Geissleria kriegeri</i> <i>Geissleria decussia</i> <i>Geissleria punctifera</i>	Mavatha - Amer fort (Jaipur) <sup>8</sup>
21.	<i>Gomphonema lanceolatum</i> <i>Gomphonema parvulum</i> <i>Gomphonema clavatooides</i>	Pools and ditches surrounding the town (Pratapgarh) <sup>9</sup> , Kishore Sagar <sup>17</sup> , Chambal river (Kota) <sup>13</sup> , Galta Kund, Mavtha (Jaipur) <sup>8</sup> Pichola lake <sup>16</sup> , Jaisamand lake (Udaipur) <sup>21</sup> , Indira Gandhi Canal - Ghaggar river Hanumangarh) <sup>6</sup> .
22.	<i>Gyrosigma baikalensis</i> <i>Gyrosigma maharashtrensis</i>	Kaylana lake (Jodhpur) <sup>15</sup> .
23.	<i>Hantzschia amphioxys</i>	Pools and ditches surrounding the town (Pratapgarh) <sup>9</sup> , Galta Kund (Jaipur) <sup>8</sup> Chambal river (Kota) <sup>13</sup> . The arid region of Rajasthan (Jaisalmer, Jodhpur, Bikaner, Churu) <sup>11</sup> .
24.	<i>Melosira granulate</i> <i>Melosira varians</i>	Pushkkar lake (Pushkar) <sup>10</sup> , Mansagar lake, Jag Mahal, Galta Kund, Mavatha pond (Jaipur) <sup>8</sup> Chambal river (Kota) <sup>13</sup> ,

		Jasisamand lake (Udaipur) <sup>21</sup> , Indira Gandhi Canal - Ghagger river (Hanumangarh) <sup>6</sup> .
25.	<i>Meridion lineare</i> <i>Meridion circulare</i>	Indira Gandhi Canal - Ghagger river (Hanumangarh) <sup>6</sup> .
26.	<i>Navicula cuspidate</i> <i>Navicula radiosa</i> <i>Navicula mutica</i> <i>Navicula viridula</i>	Pools and ditches surrounding the town (Pratapgarh) <sup>9</sup> , Kishore Sagar (Kota) <sup>17</sup> , Pushkar lake (Pushkar) <sup>10</sup> , Galta kund, Mansagar lake, Mavatha pond (Jaipur) <sup>8</sup> Chambal river (Kota) <sup>13</sup> , Jasisamand lake (Udaipur) <sup>21</sup> , Indira Gandhi Canal, Ghagger river (Hanumangarh) <sup>6</sup> .
27.	<i>Neidium ampliatum</i>	Pools and ditches surrounding the town, (Pratapgarh) <sup>9</sup> , Kishore Sagar <sup>17</sup> , Chambal river (Kota) <sup>13</sup> , Jasisamand lake (Udaipur) <sup>21</sup> .
28.	<i>Nitzschia amphibian</i> <i>Nitzschia palea</i> <i>Nitzschia thermalis</i> <i>Nitzschia commutate</i> <i>Nitzschia lineari</i> <i>Nitzschia tryblionella</i> <i>Nitzschia jugata</i> <i>Nitzschia frustulum</i> <i>Nitzschia gandersheimensis</i> <i>Nitzschia sigma</i> <i>Nitzschia filiformis</i>	Pools and ditches surrounding the town, (Pratapgarh) <sup>9</sup> , Galta Kund, Mavatha, Amer fort, Mansagar lake - Jag Mahal (Jaipur) <sup>8</sup> Pushkar lake (Pushkar) <sup>10</sup> , Pichola lake (Udaipur) <sup>16</sup> , Chambal river (Kota) <sup>13</sup> , GangCanal (Sri Ganganagar) <sup>18</sup> , Fatehpuria pond, Sethani Johada, Pithana Johada, Droun pond, Manaksar pond, Natho pond, Talchhappar pond, Chadwas pond, Parmana pond, Girdhar pond (Churu) <sup>12</sup> . The arid region of Rajasthan (Jaisalmer, Jodhpur, Bikaner & Churu) <sup>11</sup> .
29.	<i>Pinnularia macra</i> <i>Pinnularia microstauron</i> <i>Pinnularia gihha</i> <i>Pinnularia brevicostata</i>	Pools and ditches surrounding the town (Pratapgarh) <sup>9</sup> , Galta Kund (Jaipur) <sup>8</sup> Chambal river (Kota) <sup>13</sup> , Jasisamand lake (Udaipur) <sup>21</sup> .
30.	<i>Rhopalodia gibberula</i>	Chambal river (Kota) <sup>13</sup> Jasisamand lake, (Udaipur) <sup>21</sup> .
31.	<i>Sellaphora densistriata</i> <i>Sellaphora pupula</i>	Chambal river (Kota) <sup>13</sup> .
32.	<i>Stauronies phoenicenteron</i>	Kaylana Lake (Jodhpur) <sup>15</sup> .
33.	<i>Stephanio discus</i>	Indira Gandhi Canal, Ghagger river (Hanumangarh) <sup>6</sup> .
34.	<i>Stephano discushantzschii</i>	Kunda reservoir open pond (Bharatpur) <sup>20</sup> .
35.	<i>Suireria tenera</i>	Kunda reservoir, open pond- (Bharatpur) <sup>20</sup> .
36.	<i>Surirelia robusta</i> <i>Surirella tener</i> <i>Surirella lanceolata</i>	Pools and ditches surrounding the town, (Pratapgarh) <sup>9</sup> , Kishore Sagar (Kota) <sup>17</sup> , Pushkar lake (Pushkar) <sup>10</sup> , Jasisamand lake (Udaipur) <sup>21</sup> .
37.	<i>Synedra fasculata</i> <i>Synedra rumpens</i> <i>Synedra ulna</i>	Kunda reservoir - open pond (Bharatpur) <sup>20</sup> , Pools and ditches surrounding the town (Pratapgarh) <sup>9</sup> , Galta Kund (Jaipur) <sup>8</sup> Kishore Sagar (Kota) <sup>17</sup> .

### Conclusion

This review study revealed that the most common diatoms reported in the water bodies of Rajasthan belong to species *Navicula*, *Nitzschia*, *Cyclotella*, *Synedra*, *Fragilaria* and *Gomphonema*, whereas some site specific diatom's species are also reported like *Stauroneis* in Kaylana lake of Jodhpur, *Brachysira* in Chambal river, Kota.

A total of 37 diatom species are reported so far from Rajasthan, in spite of having number of rivers, fresh and saline lakes and playas, pond and puddles. Rajasthan, being having diverse habitat for diatoms, need much more and proper designed studies to explore this important group of tiny organism. This review is only providing a check list of diatoms reported till date.

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