New record of fresh water ciliates (Protozoa, Ciliophora) from Tigris river in Baghdad city, Iraq

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Abstract. Documenting the biodiversity and biogeography of ciliates will help expand the overall knowledge within the field, as well as, shed new light on the dispersal and survival potential for other microorganisms, such as protists. As organisms at the base of food webs, ciliates are an essential part of the microbial loop and the ecosystems that they support. This study deals with ciliates community in freshwater of Tigris river within Baghdad city. Four sites were chosen at Al-Gre’a’t & Al-Adhamiya area at the riverbank. Total of 44 ciliophora taxa were detected, 22 taxa of which were identified to the species level and 22 taxa to the genus level. Among them, 11 taxa were new recording for Tigris river in Baghdad city: Cyrtolophosis sp., Monochilum frontatum, Orborhabdostyla bromelicola, Ophrydium sessile, Scyphidia sp., Vortecilla convallaria, Vortecilla octava, Zoothamnium Bory, Tokophrya lemnanum, Urostyla sp. and Stentor fluiginosus.

Keywords. Protists, Ciliates community, Tigris river, Ciliophora taxa.

1. Introduction

The Ciliates are unicellular microscopic eukaryotes moving with hair-like projections called cilia [1]; they have appropriate characteristics that being a large group found in all aquatic environments [2]; the short duration of their life cycle with high average of reproduction and authorized detection of environmental impacts in a short period [3]. Ciliates are the most prominent and major group of eukaryotic [4] which occur in alternative kind of environments, wherever there are moisture, sufficient nutrients and suitable microhabitats [5]. These organisms are found from the poles to the equator, in hot springs and in sea ice, in tropical forest litter and desert soils, in major oceans to the small temporary ponds and flooded regions of the inland waters [6, 7, 8, 9, 10, 11, 12, 13, 14]. Many studies showed that obviously ciliated protozoa are components of many microhabitats [15, 16]. The phylum Ciliophora is an ancient group, present on the earth for hundreds of millions of years [17]. Ciliates have an importance in total ecosystem function in some environments because they are the top predators in the microbial food webs [18, 19, 20], and they have a role in microbial loop [1, 9, 41]. Furthermore, ciliates are effective bioindicators of freshwater environments and they can be used in biomonitoring of streams, reservoirs and lakes under different scales of anthropogenic impact [21, 22, 23]. In addition, they are reducing conditions or indicative of oxidizing in the decomposition of...
organic matter, share in phosphorus and nitrogen cycling, sensitive to different concentrations of pollutants and have high taxonomic density, providing responses to different levels of contamination [24]. In spite of their broad functionality, taxonomic diversity, and ability to gain large population densities in a short period of time [25], the structure and geographical distribution of ciliate communities is still uninvestigated in many regions of the world [26, 27] and poses an obstruction for studies of ciliate biogeography. Research into ciliates are differential biased to institutions of the researchers and their sampling areas mostly in Northern Europe [28]. There are over 1,100 ciliates genera and over 8,000 species included in these genera [29]; in spite of some argue that this diversity might represent only 10% of the actual diversity of species [28]. The mainly aim of this study was to document and record ciliates species which could be new recording in Tigris river at Baghdad city.

2. Materials and Methods

2.1. The study area and Methodology

This study deals with ciliates community in freshwater of Tigris river within Baghdad city that is located in the Mesopotamia alluvial plain between latitudes 33°14' - 33° 25' N and longitudes 44° 31' - 44° 17' E. Four sites were chosen at Al-Gra’t and Al-Adhamiya area at the riverbank (Figure 1). These sites are located close to the residential, agricultural and restaurants area within Baghdad city, thus, there is a lot of water utilization such as transportation purposes, household usage, agricultural usage and restaurant waste. Variable species of vegetation (reeds and wild grasses) were observed to grow at S4, while the remaining three sites was paved at the edges of the river. Monthly intervals, three samples were collected from each site of the riverbank over a period from June to September 2020, and each sample was 60 liters of water which was horizontally taken from the water surface with the aid of plankton net. This net made of bolting cloth with a fine mesh size (40 µm), with a small bottle container of 30 ml capacity attached to its narrow end [30].

2.2. Water samples

During the period of study (48), the fresh water samples were examined. One milliliter from each collecting water sample was investigated within 5-48 hours [31, 32, 33] by direct observation. All samples were examined alive [33] with the aid of compound microscope (Olympus, Japan) at a magnification of (X10- X40), and identification guides by [31, 34, 35, 36]. The classification of ciliates were followed [29]. Each species was photographed using camera (Casio). All of the photographs presented here are digitally processed (cropped, resized, contrast enhanced, white balance corrected, and background removed).

![Figure 1. The map of Iraq shows the sampling area at A. Ocular micrometer was used for specimens](image)
3. Results and Discussion

Total of 44 ciliophora taxa were detected; 22 taxa of which were identified to the species level and 22 taxa to the genus level (table 1). Among them 11 taxa were new recording for Tigris river in Baghdad city, while the remaining previously recorded by [37]. Number of recording species in the present study was lower than [38], who recorded 208 ciliates species in Argentina; [39] recorded 84 ciliates species from Southern Brazil and [40] recorded 63 ciliates species from Tigris river in Baghdad city, while it was higher than [41] who recorded 7 ciliates species from Salim Ali Lake in Aurangabad. The lower number of ciliates were recorded in the present study could be refer to both limited of investigated area and limited duration of this work. Some taxa are rare in one environment could be abundant in others and the species which are rare under certain environment conditions could become abundant when the chemical, physical and biological inconsistent of their habitat are change. Despite it's not known if there are some species which are always rare in every suitable environment [42].

The new recording ciliophora taxa in Tigris river within Baghdad city are: *Cyrtolophosis* sp., *Monochilum frontatum*, *Orborhabdostyla bromelicola*, *Ophrydium sessile*, *Scyphidia* sp., *Vortecilla convallaria*, *Vortecilla octava*, *Zoothamnium bory*, *Tokophrya lemnarum*, *Urostyla* sp. and *Stentor fluiginosus*.

**Table 1.** The taxonomy of the species in phylum ciliophora (Doflein, 1901) were recorded from freshwater of Tigris river at four investigated sites during the study period from June to September 2020.

| No. | Protozoa taxa                      | Class                | Order            | Family                      |
|-----|-----------------------------------|----------------------|------------------|-----------------------------|
| 1.  | *Cyrtolophosis* sp. Stokes,1885   | Colpodea            | Cyrtolophosidida | Cyrtolophosididae           |
| 2.  | *Lacrymaria olar* Müller,1786     | Litostomata         | Haptorida        | Lacrymaridiae               |
| 3.  | *Litonotus* sp. Wrzesniowski,1870 | Pleurostomata       |                  |                             |
| 4.  | *Pseudomicrothorax* sp.           | Microthoracida      |                  | Pseudomicrothoracida        |
|     | Mermod,1914                        |                      |                  |                             |
| 5.  | *Monochilum frontatum* Schewiakoff,1893 | Oligohymenophorea | Tetrahymenida   | Glaucidae                   |
| 6.  | *Frontonia* sp. Ehrenberg,1838    | Peniculida          |                  | Frondoniidae                |
| 7.  | *Paramecium aurelia* Müller, 1773 |                      |                  | Parameciidae                |
| 8.  | *Paramecium caudatum* Ehrenberg,1833 |                      |                  |                             |
| 9.  | *Paramecium multimicronucleatum* Powers& Mitchell,1910 | Sessilida         | Epistylidae      | Opercularidae               |
| 10. | *Epistylis* sp. Ehrenberg,1830    |                      |                  |                             |
| 11. | *Orborhabdostyla bromelicola* nov. Spec. |                      |                  |                             |
| 12. | *Ophrydium sessile* Ehrenberg,1830 |                      |                  | Ophrydiidae                 |
| 13. | *Scyphidia* sp. Dujardin,1841     |                      |                  | Scyphidiidae                |
| 14. | *Colthurnia* sp. Ehrenberg,1831   |                      |                  | Vaginicolidae               |
| 15. | *Pyxicola affinis* Kent, 1881     |                      |                  |                             |
| 16. | *Thuricola* sp. Kent, 1881        |                      |                  |                             |
| 17. | *Vaginicola* sp. Lamarck,1816     |                      |                  |                             |
| 18. | *Carchesium* sp. Ehrenberg,1831   |                      |                  | Vorticellidae               |
| 19. | *Vortecilla* sp. Linnaeus,1767    |                      |                  |                             |
| 20. | *Vortecilla campanula* Ehrenberg,1831 |                      |                  |                             |
| 21. | *Vortecilla convallaria* Linnaeus,1758 |                      |                  |                             |
| 22. | *Vortecilla microstoma* Ehrenberg,1830 |                      |                  |                             |
| 23. | *Vortecilla octava* Stokes,1885   |                      |                  |                             |
| No. | Protozoa taxa | Class | Order | Family |
|-----|---------------|-------|-------|--------|
| 24. | *Vorticella striata* Dujardin, 1841 | | | |
| 25. | *Zoothamnium* Bory de St. Vincent, 1824 | | | Zoothamnidae |
| 26. | *Cinetochnium* sp. Perty, 1849 | | | Cinetochilidae |
| 27. | *Clytidium* sp. Müller, 1773 | | Pleuronematida | Cyclidiidae |
| 28. | *Chilodonella* sp. Strand, 1928 | Phyllopharyngea | Chlamydodontida | Chilodonellidae |
| 29. | *Acineta* sp. Ehrenberg, 1834 | | | Acinetidae |
| 30. | *Tokophrya lemonarum* Stein, 1859 | | | Tokophryidae |
| 31. | *Sphaerophrya* sp. Claperède & Lachmann, 1859 | | Exogenida | Podophryidae |
| 32. | *Coleps hirtus* Müller, 1786 | Prostomataea | Prorodontida | Colepidae |
| 33. | *Euplotes* sp. Ehrenberg, 1831 | Spirotrichea | Euplotida | Euplotidae |
| 35. | *Strombidium* sp. Claperède & Lachmann, 1859 | | Strombiidiidae | Strombiidae |
| 36. | *Halteria* sp. Dujardin, 1841 | | | Halteriidae |
| 37. | *Urostyla* sp. Ehrenberg, 1830 | Sporadotrichida | | Urostylidae |
| 38. | *Spirostomum ambiguum* Ehrenberg, 1834 | Heterotrichia | Heterotrichida | Spirostomidae |
| 39. | *Spirostomum minus* Roux, 1901 | | | |
| 40. | *Stentor* sp. Oken | | Stentoridae | |
| 41. | *Stentor fluiginosus* Forbes, 1891 | | | |
| 42. | *Stentor niger* Müller, 1773 | | | |
| 43. | *Stentor polymorphus* Müller, 1773 | | | |
| 44. | *Loxodes magnus* Stokes, 1887 | Karyorelictea | Loxodida | Loxodidae |

Note: * new recording species

3.1. Description and Photographs of the new recording species obtained during the study period (from June to September 2020)

3.1.1. *Cyrtolophosis* sp. Stokes, 1885

Small species, ovoid to pyriform in shape. Somatic ciliation uniform in longitudinal rows curving a little down the body and there is an anterior tuft of cilia in some species. The oral aperture within a shallow groove in the anterior third of the cell, and some species produce gelatinous tubes. Spherical macronucleus located centrally, and the contractile vacuole is in posterior third of body. Feeds on bacteria; Length of cell less than 40 μm as shown in Figure 2.

3.1.2. *Monochilum frontatum* Schewiakoff, 1892

Medium to large species (60-200 μm long), ellipsoid to elongate ovoid in shape. Oral aperture occurs in the anterior body half usually about a quarter of the cell length from the apical end, oval in outline and leads to a conical buccal cavity. There is an undulating membrane on the right and a prominent membranelle on its left of the oral aperture. In the posterior body half there is a contractile vacuole, usually near the equator. Ovoid macronucleus is locate centrally. Anterior end is broader, ventrally flattened, dorsally slightly convex, macronucleus is ellipsoid, feeds on algae. As shown in Figure 3.

3.1.3. *Orborhabdostyla bromelicola* nov. Spec

Narrowly conical, more or less asymmetrical. Size about (50–75 × 13–18) μm in vivo, with stalk-like narrowed usually less than 10 μm long and 2 μm wide. Cytoproct and Contractile vacuole on dorsal
wall of vestibulum slightly posterior of oral bulge. Peniculus 2 shortened posteriorly. Highly contractile. Fresh water cell. As shown in Figure-4.

3.1.4. Ophrydium sessile Ehrenberg, 1830

Cell body is long and contractile, in gelatinous matrix and posterior end rounded or pointed. As shown in Figure 5.

3.1.5. Scyphidia sp. Dujardin, 1841

Body drawn out, some species seem stalklike at rear, peristomal disc not stalked. There is no trochal band when mature, macronucleus often C-shaped and long. Cell body length about 60 μm. As shown in Figure 6.

3.1.6. Vortecilla convallaria Linnaeus

Body with bell-shaped; length (30-120) μm, width (35-70) μm, peristome width is (55-75) μm and stalk length is (100-500) μm. The animal never looks dark, but it is often yellow-tinted because there are (no) or (a few) darkishlooking refractile granules; the peristomal area is narrower than in V. campanula; the pellicle annulation is easily visible; contractile vacuole is one nearby the buccal cavity, food vacuole within oval contour as shown in Figure 7.

3.1.7. Vortecilla octava Stokes (V. striata Dujardin, 1841)

Vase-like shape, body length is 20-60 μm, width is 15-40 μm, peristome width is 13-40 μm and stalk length 20-300 μm. Vortecilla octava is similar to V. microstoma but smaller than it. The macronucleus lies transversal to the longitudinal axis, the peristome border shows much variation and it is thicker than in V. microstoma. Cytoplasm translucent or a little misty white, pellicle annulations pretty distinct, about 25-40 striae, surface of body a little ribbed, macronucleus sausage-like and thick, contractile vacuole is one nearby the buccal cavity as shown in Figure 8.

3.1.8. Zoothamnium Bory de St. Vincent, 1826

Resemble to Carchesium, but myonemes of all stalks of a colony are continuous together, so that the entire colony contracts or expands with each other, fresh or salt water, colonies some millimeters high. As shown in Figure 9.

3.1.9. Tokophrya lemnarum Bütschli

Pyramidal or pyriform, with no lorica, tentacles order in 1-4 fascicles on anterior surface, stalk not tough, endogenous budding is simple, fresh water. Tentacles emerge from distal, bulbous processes, about (70-260) μm as shown in Figure 10.

3.1.10. Urostyla sp. Ehrenberg, 1830

Ellipsoid with 2 or more right marginal cirri (files). Pliable, posterior rounded, ventral surface is flatten with (4-10) rows of cirri, 2 marginal rows, (5-12) anals and 3 or more frontals as shown in Figure 11.

3.1.11. Stentor fluiginosus Forbes, 1891
Cylindrical or trumpet-shaped (when extended), contractile vacuole anterior-left; highly contractile; some with mucilaginous lorica; conspicuous peristomal field frontal, several micronuclei and a single macronucleus; cortical and cytoplasmic granules coloured with yellow-brown or red-orange. Body length is (200-300) μm when fully extended; freshwater cell as shown in Figure 12.
4. Conclusion

A total of 44 ciliophora taxa were detected; 22 taxa of which were identified to the species level and 22 taxa to the genus level. Among them 11 taxa were new recording for Tigris river in Baghdad city: *Cyrtolophosis* sp., *Monochilum frontatum*, *Orborhabdostyla bromelicola*, *Ophrydium sessile*, *Scyphidia* sp., *Vortecilla convallaria*, *Vortecilla octava*, *Zoothamnium bory*, *Tokophrya lemnarum*, *Urostyla* sp. and *Stentor fluiginosus*.

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