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ORIGINAL ARTICLE

NEW RECORDS OF FREE-LIVING PROTOZOA (SARCODINA) FROM BAGHDAD CITY, IRAQ

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ABSTRACT

Studies in Iraq that concerned identification of free-living Protozoa (sarcodina) are scarce; so the current study deals with these protozoan communities inhabiting the Tigris River in Baghdad City. Sampling collection stations have been selected at each of AL-Gherai'at and AL-Adhamiyah area adjacent to the river. Monthly intervals sampling with three samples were collected from each station from June to September 2020. Total of 23 sarcodina taxa were listed, out of them 5 taxa were new record to the Tigris River in Baghdad: *Difflugia urceolata* Carter, 1864 (Arcellinida, Difflugiidae), *Heleopera perapetricola* Leidy, 1879 (Arcellinida, Heleoperidae), *Rhaphidiophrys pallida* F.E. Schulze, 1874 (Centrohelida, Raphidiophridae), *Saccamoeba* sp. (Amoebida, Hartmannellidae) and *Thecamoeba* sp. (Amoebida, Thecamoebidae).

Keywords: Amoebida, Arcellinida, Centrohelida, Protozoa, Sarcodina, Tigris River.

INTRODUCTION

Free-living amoebae (FLA) are the most widespread protozoa found in the environment; FLA are isolated from water, soil, sediments, air, sewage and dust (Rodriguez-Zaragoza, 1994). These organisms feed on other protozoa, bacteria, fungi, algae and organic debris in biofilms or in the planktonic phase; therefore, they affect the structure of microbial communities (Erkta *et al*., 2020). Orderly, the community of FLA depends on the diversity and abundance of bacteria in each of the biofilm and planktonic phase (Cavalier-Smith, 1993; Hahn and Höfle, 2001; Rønn *et al.*, 2002; Parry, 2004; Cavalier-Smith, 2009).

In the last 50 years, the ever-rising influences of humans on their environment by urbanization, industry and climate change has led to an 80% decline in the biodiversity of freshwater (WWF, 2018). The three forms of amoeboid protists: lobose, filose, and reticulose amoebae that can be distinguished by their pseudopodial patterns; the most prevalent amoeba is the lobose, rarely are reticulose and filose species isolated (Smirnov and Brown, 2004).

Heliozoa is one of the most long-lived of the classic protozoan taxa, and it can be found in a large number of contemporary protists, protoctists and protozoa (Corliss, 1994). Also, it is a spherically symmetrical group of protists with granule-carrying axopods that radiate and lose any intracellular inorganic skeleton as well as a central capsule; an organic or inorganic skeleton is always extracellular (Mikrjukov, 1998).

Testate amoebae have important roles in structuring of aquatic ecosystems and have each of interesting characteristics and ecological advantages for scientific investigations (Schwind *et al.*, 2016). Also, they have shells of different compositions, sizes and shapes (Bonnet, 1975). The testate amoeba which diverse protest group and enclose their cell body within a test are importance indicators in the ecological system for their abundance (in fresh water, wetlands and moist soils); sensitivity to the environmental conditions; rapid generation times; high preservation potential (Mitchell *et al.*, 2008).

The lobose testate amoebae are globally distributed in both aquatic and terrestrial environments; they are consuming prey (such as: bacteria, algae, smaller protists, yeast, etc.) via phagocytosis; they are used as indicators for each of acidity of lake (Patterson *et al.*, 2002); industrial influences (Nasser *et al.*, 2016); quality of water (Roe *et al.*, 2010); seasonal change of environment and ecosystem health (Li *et al*., 2017). Also, under unfavorable conditions they become dormant cysts, for example: lack of satisfying food and dried conditions of the environment. Hence, excystation will occur when the environmental conditions enhance (or form freeze-resistant, winter resting stages that are not encysted in some soil-dwelling amoebae in temperate regions). Furthermore, they are important organisms of aquatic and terrestrial microbial linkages in food webs between microbes and higher organisms, like invertebrates (Anderson, 2017). Life cycles of amoebae vary between systematic groups and related species, variation is found in every stage of amoeba life cycle (Smirnov and Brown, 2004).

The aim of this study is to identify protozoan's taxa (sarcodina's taxa) and provide database on some water sarcodina's community in Tigris River at Baghdad City.

MATERIALS AND METHODS

Study area

This study deals with sarcodina communities inhabiting Tigris riverbank within Baghdad city. Four sampling stations were selected at each of AL-Gheraiʿat (S1: 33˚23'28.8"N 44˚21'28.7"E; S2: 33˚23'32.8"N 44˚21'22.8"E and S3: 33˚23'34.6"N 44˚21'13.5"E) and AL-Adhamiyah area (S4: 33˚21'27.0"N 44˚22'26.2"E) at Tigris riverbank. Observed variable species of vegetation (reeds and wild grasses) which grow at S4, while others sites were covered with stones at the edges of the river bank.

From June to September 2020, three samples at monthly intervals, each measuring 60 liters, were taken from each sampling station. Protozoans were collected from the water's surface horizontally using plankton net that was 40 µm (Ibrahim and Abdullah, 2008).

Water samples

Equal to 48 freshwater samples were examined during the period of study. From each sample, one milliliter was examined throughout (5-48) hours by direct observation (Buitkamp, 1979; Foissner, 1987; Şenler and Yildiz, 2004). All water samples were examined alive via light microscope (Şenler and Yildiz, 2004). Sarcodina species were identified and classified according to Kudo (1966), Levin *et al*. (1980), Smirnov and Brown (2004), Smirnov *et al*. (2011), Adl *et al*. (2012) and Protist Information Server (2018). Photographing all species was done by camera (Casio). Ocular micrometer was used for specimens measuring.

RESULTS AND DISCUSSION

A total of 23 sarcodina taxa were identified (Tab. 1), out of them 5 taxa were new record to the Tigris River in Baghdad, whilst the remaining were recorded previously by Kadhim and Mahmood (2013). The number of documented species in this research was lower than Lihua *et al*. (2014) who recorded 169 sarcodina species in China; Kadhim and Mahmood (2013) recorded 24 sarcodina species in Iraq. In contrast, their record was higher than Medeiros *et al*. (2013) who listed 19 sarcodina species in Brazilian; Chen *et al*. (2018) who recorded 6 sarcodina species from Longfend wetland in China.

The low number of recording Sarcodina taxa in this investigation may be referred to the restricted investigation area and the limited duration of this study. Rare species could be influenced by various environmental changeable. Hence, the distribution of Sarcodina (such as testate amoebae) was affected by influences of climate and human activities (Lihua *et al*., 2014). The new recording sarcodina taxa are: *Difflugia urceolata* Carter, 1864 (Arcellinida, Difflugiidae), *Heleopera perapetricola* Leidy, 1879 (Arcellinida, Heleoperidae), *Rhaphidiophrys pallida* F. E. Schulze, 1874 (Centrohelida, Raphidiophridae), *Saccamoeba* sp. (Amoebida, Hartmannellidae) and *Thecamoeba* sp. (Amoebida, Thecamoebidae).

Table (1): Taxonomy of Sarcodina taxa according to Kudo (1966), Levin *et al*. (1980), Smirnov and Brown (2004), Smirnov *et al*.(2011) and Adl *et al*. (2012) and Protist Information Server (2018), that recorded from sampling sites during the study period.

Sarcodina taxa	Class	Order	Family
Choanocystis aculata Hertwig & Lesser, 1874	Centrohelea	Centrohelida	Choanocytidae
Heterophrys sp.			Hetrophridae
Euglypha sp.	Filosia	Aconchulinida	Euglyphidae
Actinoshaerium eichornni Ehreberg, 1840	Heliozoea	Actinophryida	Actinophyridae
Actinophrys sol Ehreberg, 1830			Actinophyridae
**Rhaphidiophrys pallida* F.E. Schulze,1874		Centrohelida	Raphidiophridae
Amoeba radiosa Ehreberg, 1830	Lobosea	Amoebida	Amoebidae
Polychaos sp.			Amoebidae
Trichamoeba villosa Wallich, 1863			Amoebidae
**Thecamoeba* sp.			Thecamoebidae

Thecamoeba striata Penard, 1890			Thecamoebidae
**Saccamoeba* sp.			Hartmannellidae
Mayorella sp.			Mayorellidae
Kortenivella sp.			Paramoebidae
Pelomyxa sp.			Pelomyxidae
Arcella sp.		Arcellinida	Arcellidae
Centropyxis aculata Ehreberg, 1830			Centropyxidae
Centropyxis ecornis Ehreberg, 1841			Centropyxidae
Difflugia sp.			Difflugiidae
Difflugia acuminate Ehrenberg, 1838			Difflugiidae
* *Difflugia urceolate Carter, 1864*			Difflugiidae
**Heleopera petricola* Leidy, 1879			Heleoperidae
Plagiophrys sp.			Psedodifflugiidae

(* new record species for Iraq)

1. ***Difflugia urceolata*** Carter, 1864

Description: Test for a broad oval or spherical shape. Aperture is circular, with a recurved collar that extends as a broad rim. Mineral grains or diatom frustules are often combined and fused together with organic substances to form a shell. Test generally without spines. Length of shell 235-280 µm as shown in Plate (1).

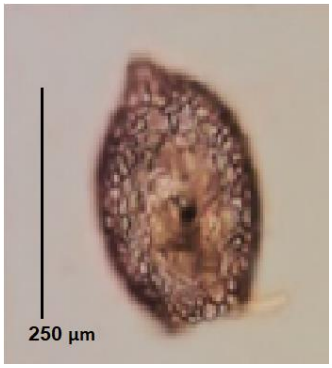

Plate (1): *Difflugia urceolata*.

2. *Heleopera petricola* Leidy, 1879

Description: Chitinous test, colored (occasionally light yellow or light violet), practically always rough with adherent sand-grains. In lateral view, pseudostome narrow, elliptic, and notched; in frontal view, pseudostome with more or less convex or truncated. Lateral margins slightly convex. Length of shell: 80-100 µm as shown in Plate (2).

Plate (2): *Heleopera petricola*.

3. *Rhaphidiophrys pallida* Schultze, 1874

Description: Ordered radial siliceous spicules; outer gelatinous envelope filled with curved lenticular spicules, creating accumulations around pseudopodia; diameter 40 µm; spicules 20 µm long as shown in Plate (3).

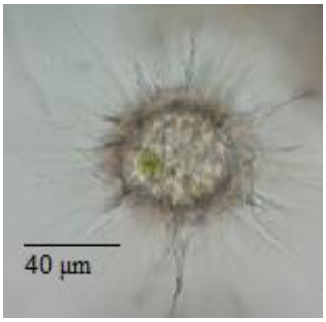

Plate (3): *Rhaphidiophrys pallida*.

4. *Saccamoeba* sp.

Description: In continuous locomotion, limax amoeba with hyaline cap decreased to shallow crescent or missing; uroid with villous bulb (frequently present) and more or less stiff fine; a bulging contractile vacuole; with cytoplasmic crystals, measurement: 43.75 – 125 µm as shown in Plate (4).

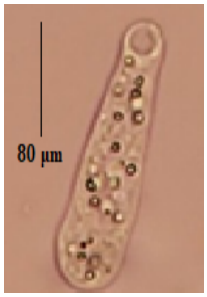

Plate (4): *Saccamoeba* sp.

5. *Thecamoeba* sp.

Description: up to 200 µm, ovoid, flattened and oblong; uninucleate, posterior surface ridged or wrinkled with longitudinal surface folds and appearance of thicker pellicle, hyaloplasm a crescent posterior end along sides with thin extensions toward posterior end as shown in Plate (5).

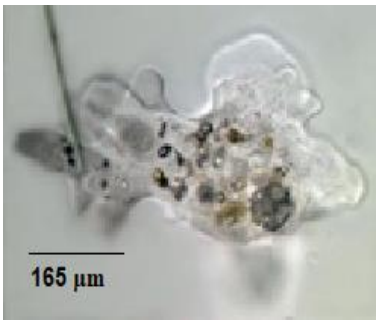

Plate (5): *Thecamoeba* sp.

CONCLUSIONS

The current study deals with protozoan communities inhabiting the Tigris River in Baghdad city. Sampling collection stations have been selected at each of AL-Gherai'at and AL-Adhamiyah area adjacent to the river. From June to September 2020, three samples were taken at monthly intervals from each location. Total of 23 sarcodina taxa were found, out of them 5 taxa were new record to the Tigris River in Baghdad: *D. urceolata* (Arcellinida, Difflugiidae), *H. perapetricola* (Arcellinida, Heleoperidae), *R. pallida* (Centrohelida, Raphidiophridae), *Saccamoeba* sp. (Amoebida, Hartmannellidae) and *Thecamoeba* sp. (Amoebida, Thecamoebidae).The low number Xinvestigation area and the limited duration of this study.

CONFLICTS OF INTERESTSTATEMENT

"There are no disclosed conflicts of interest for the author".

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تسجيل جديد لابتدائيات المياه العذبة (اللحميات) لنهر دجلة في مدينة بغداد، العراق

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تأريخ الاستلام: 2022/2/10، تأريخ القبول: 2022/10/7، تأريخ النشر: 2022/12/20

الخلاصة

الدراسات التي تهتم بتصنيف ابتدائيات المياه العذبة (اللحميات) في العراق قليلة، لذا فأن الدراسة الحالية تتعامل مع مجاميع الابتدائيات المتوطنة في نهر دجلة لمدينة بغداد. تم اختيار محطات جمع العينات في كل من منطقتي الكريعات و الاعظمية المحاذية للنهر. تم جمع العينات شهرياً بواقع ثلاث عينات من كل محطة خلال الفترة من تموز ولغاية ايلول 2020.

سجلت 23 مرتبة تصنيفية من اللحميات، بينهم 5 مراتب تصنيفية تعتبر تسجيل جديد لنهر دجلة في مدينة بغداد:

Difflugia urceolata Carter, 1864 (Arcellinida, Difflugiidae)

Heleopera perapetricola Leidy, 1879 (Arcellinida, Heleoperidae)

Rhaphidiophrys pallida F.E. Schulze, 1874 (Centrohelida, Raphidiophridae)

Saccamoeba sp. (Amoebida, Hartmannellidae)

Thecamoeba sp. (Amoebida, Thecamoebidae).