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Planktonic protozoan population in the Southeastern Mediterranean off Egypt

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ABSTRACT

Abundance, distribution and population structure of planktonic protozoans in the Southeastern Mediterranean off Egypt were investigated during the period from April 2008 to February 2010. Protozoan population constituted 5.4% of the total zooplankton counts. Tintinnida were the highest abundant order (average 30.4 ind.m^{-3} constituting about 67.1% of the total protozoan counts) followed by Foraminifera and Radiolaria. A total of 116 protozoan species were identified, out of them 86 tintinnids, 15 foraminifers and 15 radiolarians. Among them, 56 species are new records in the Egyptian water. Temporal distribution of protozoan abundance indicated that they flourished during the cold months (the highest mean value, 90.3 ind.m^{-3} was recorded during winter). There was a decrease in abundance towards the offshore where the annual averages in the three depth zones; inshore, middle and offshore were 59, 44.3 and 32.6 ind.m^{-3} respectively, except at Fouka section where protozoan abundance decreased westwards. Generally, it would be concluded that, planktonic protozoan population in the investigated area is low in abundance but is highly diversified.

Introduction

Planktonic protozoan populations play an important role in the transfer of energy and carbon from bacterioplankton and phytoplankton to higher trophic levels through the microbial food web (Bernard and Rassoulzadegan, 1993). They are considered as a link between herbivorous food chain and microbial food web (Bojanic et al., 2005). Therefore, changes in the abundance or biomass of protozoan species are considered as indicators of changes in the microplankton community, as a consequence of the changed trophic state (Bojanic, 2007).

Previous works on planktonic protozoans in the Mediterranean water of Egypt were mostly done on zooplankton within coastal water (Aboul Ezz, 1994; Hussein, 1997; Nour El-Din, 2001; Abdel-Aziz and Aboul-Ezz, 2003; Zakaria, 2006; Dorgham et al., 2009). The present work is planned to provide additional data on abundance, distribution and population structure of planktonic protozoans in the Southeastern Mediterranean Coast off Egypt. The zoogeography of the recorded species is also included to follow up the origin of the new records.

Materials and methods

The study area lies between longitudes 25° 30′ E, 29° 30′ E and extends northward to latitude 32° N covering the area from Fouka to El-Sallum. Fig. 1 illustrates the study area and locations of the sampling stations.

Samples were collected from six sections nearly perpendicular to the coast. Each section comprised three stations covering the inshore zone of depth ≤ 50 m, middle zone of depth between 50 and 100 m and offshore zone of depth ≥ 200 m.

Using the Egyptian Research Vessel Salsabeel, 4 cruises were performed during the period 2008–2010. Zooplankton samples were collected by vertical hauls (from bottom to surface) using plankton net of 55 μm mesh size. They were preserved in 4% neutral formalin solution and their volumes were concentrated to 100 ml. Three replicates of 3 ml were transferred into a counting cell and each protozoan species was identified and counted under a binocular research microscope. For quantitative work, the filtration coefficient of the net was considered equal to unity, thus the volume of water filtered was equal to $\pi r^2 d$, where r is the net diameter and d is the depth of water sampled. Protozoan abundance was calculated and expressed in number per cubic meter. For confirmation of the identified species several data basis on the World Wide Web was consulted. The diversity index was calculated and plotted for each section

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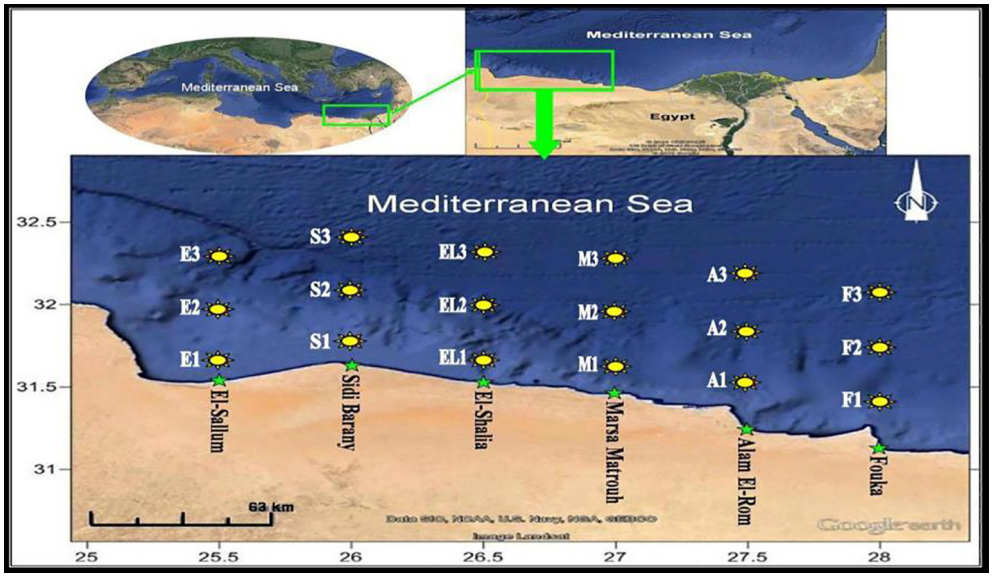

Fig. 1. Study area and locations of sampling stations.

according to Shannon-Weaver (1963) and species richness was calculated according to Margalef's (1968).

Results

In the study area, water temperature varied between 16.3 and 17.9 °C during winter and 22 and 27.8 °C in summer. The pH values ranged between 7.98 and 8.44 during winter and 8.07 and 8.6 in summer. Meanwhile salinity values ranged between 39 and 39.2 ppt. Dissolved oxygen concentrations varied between 4.13 and 5.32 ml/l in winter and 4.83 and 5.71 ml/l in summer.

Protozoan population structure

Based on the numerical density, planktonic protozoan populations constituted 5.4% of the total zooplankton counts. 116 species belonging to 52 genera, 29 families and 5 orders were identified during the present study (Table 1). Among them 56 species (38 tintinnid, 6 foraminifers and 12 radiolarians) are new records in the Egyptian waters. Tintinnida were the highest predominant (average 30.4 ind.m^{-3} constituting about 67.1% of the total protozoan counts) and diversified order (86 species). Tintinnid population was dominated by *Undella hyalina*, *Rhabdonella spiralis* and

Table 1
*: Geographical distribution of the recorded protozoan species (AO = Atlantic Ocean, IO = Indian Ocean, PO = Pacific Ocean, RS = Red Sea, MS = Mediterranean Sea, EMW = Egyptian Mediterranean waters and PS = Present Study).

Species	Geographical distribution						
	AO	IO	PO	RS	MS	EMW	PS
Kingdome: Protozoa							
Phylum: Ciliophora							
Class: Spirotrichea							
Order: Tintinnida							
Family: Codonellidae							
Codonaria cistellula (Fol) Kofo. & Camp., 1939	+	+	+	+	+		+
Codonaria oceanica (Brandt) Kofo. & Camp., 1929	+		+				+
Codonella amphorella Biedermann, 1893	+		+	+	+		+
Codonella aspera Kofo. & Camp., 1929	+		+	+	+	+	+
Codonella galea Haeckel, 1873	+		+	+	+	+	+
Codonella nationalis Brandt, 1906			+	+	+		+
Codonella perforate Entz Sr., 1884					+		+
Tintinnopsis beroidea Stein, 1867	+		+	+	+	+	+
Tintinnopsis buetschlii Daday, 1887	+			+	+	+	+
Tintinnopsis cylindrica Daday, 1887	+	+	+	+	+	+	+
Tintinnopsis lobiancoi Daday, 1887	+	+	+	+	+	+	+
Tintinnopsis orientalis Kofo. & Camp., 1929				+	+		+
Tintinnopsis radix (Imhof) Brandt, 1907	+	+	+	+	+	+	+
Family: Codonellopsidae							
Codonellopsis longa Kofo. & Camp., 1929	+	+	+	+	+	+	+
Codonellopsis morchella (Cleve) Jörgensen, 1924		+	+	+	+	+	+
Codonellopsis orthoceras (Haeck.) Jörgensen, 1924	+	+	+	+	+	+	+
Codonellopsis turbinella Kofo. & Camp., 1929					+	+	+
Family: Metacylididae							
Coxliella laciniosa (Brandt) Brandt, 1907	+	+	+	+	+	+	+
Helicostomella edentate (Fauré-Fremiet, 1924)	+			+	+	+	+
Helicostomella subulata (Ehrenb.) Jörgensen, 1924	+	+	+	+	+	+	+
Metacylis mediterranea (Meres.) Jörgensen, 1924	+	+	+		+	+	+