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New Record for a Dinoflagellate Species (*Gonyaulax pacifica* Kofoid) from Turkish Coastal Waters (Northeastern Mediterranean Sea)

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Abstract: The dinoflagellate species *Gonyaulax pacifica* Kofoid is reported for the first time from northeastern Mediterranean coast of Turkey; it has not previously been reported for any Turkish coastal waters. The morphological characteristics of this species are described in detail and information about its ecological and biogeographical distribution is given.

Key Words: *Gonyaulax pacifica*, dinoflagellate, phytoplankton, northeastern Mediterranean

Türkiye Kıyısı Sularında (Kuzeydoğu Akdeniz) Dinoflagellatlardan (*Gonyaulax pacifica* Kofoid) Yeni Bir Kayıt

Özet: Dinoflagellat üyesi *Gonyaulax* cinsine ait *Gonyaulax pacifica* Kofoid, Türkiye'nin kuzeydoğu Akdeniz kıyısı sularından ilk kez rapor edilmiştir. Bu tür aynı zamanda tüm Türkiye kıyısı suları için de yeni kayıttır. Bu türün morfolojik özellikleri detaylı olarak açıklanmış, ekolojik ve biyocoğrafik dağılımları ile ilgili bilgiler verilmiştir.

Anahtar Sözcükler: *Gonyaulax pacifica*, dinoflagellat, fitoplankton, kuzeydoğu Akdeniz

Introduction

Dinoflagellates are one of the major constituent of marine phytoplankton. They are unicellular, eucaryotic, flagellated organisms that possess both photosynthetic and nonphotosynthetic members (Taylor, 1987); 40-60% of the living species are photosynthetic. There are about 1555 dinoflagellate species in the world oceans (Gomez, 2005).

The eastern Mediterranean is described as the most oligotrophic part of the Mediterranean Sea. The high temperature prevailing in the eastern Mediterranean, especially compared to its western basin, gives this region a tropical character with regard to planktonic biota (Kimor, 1983). The oligotrophic conditions in the Mediterranean could favour the richness of dinoflagellates typical of the oligotrophic waters (Gomez, 2003). It was estimated that more than 50% of the thecate

dinoflagellate species of the world oceans are represented in the Mediterranean Sea (Kimor, 1983).

In the present study, a dinoflagellate species *Gonyaulax pacifica* Kofoid is reported for the first time from Turkish coastal waters. This record will contribute to the microplankton checklist of Turkish Seas (Koray et al., 1999).

Materials and Methods

Phytoplankton samples were collected from northeastern Mediterranean coast of Turkey (lat. 36° 28' N-36° 31' N, long. 35° 23' E-35°25' E). The location of the sampling area is shown in Figure 1. The phytoplankton samples were collected with a 55 µm mesh size standard plankton net from surface water. The samples were preserved in formaldehyde 4% final concentration.

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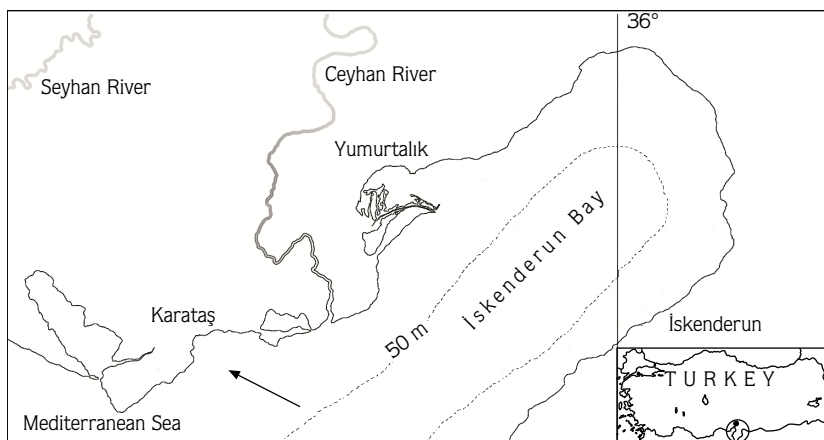


Figure 1. The location of the sampling area.

An Olympus BX-51 phase-contrast microscope was used for identification of the species. Photos were taken with an Olympus DP70 digital camera equipment. The identification and taxonomy were done according to Schiller (1933), Taylor (1976, 1987), Rampi & Bernhard (1980), Fensome et al. (1993) and Tomas (1997).

Results and Discussion

The dinoflagellate species *Gonyaulax pacifica* was very rare in the plankton samples and a few individual have been found. This species was found in February 2004. Surface water temperature was 16.1 °C and salinity was 38.6 ‰ during the sampling time. The taxonomy of this species is given as follows (Fensome et al., 1993):

Division: Dinoflagellata (Bütschli, 1885) Fensome et al., 1993

Subdivision: Dinokaryota Fensome et al., 1993

Class: Dinophyceae Pascher 1914

Subclass: Peridiniphyceae Fensome et al., 1993

Order: Gonyaulacales F. J. R. Taylor 1980

Family: Gonyaulacaceae Lindemann 1928

Genus: *Gonyaulax* Diesing 1866

The cells of members of this genus are subspherical to fusiform. The primary character of this genus is a left-handed girdle displaced up to six girdle widths.

Another feature associated with most species of *Gonyaulax* is a pronounced asymmetry in the

development of the various posterior plates (Taylor, 1976).

Many of the species of this genus are ecologically important and well characterised (Taylor, 1976). Some species belonging to this genus are described as harmful species and they cause red tide phenomenon in marine environments.

The species of this genus are differentiated based on the following characters; size and shape, plate tabulation and pattern, cingulum displacement and overhang, development of apical process and ornamentation (Tomas, 1997).

In respect to bio-geographic distribution, 21 taxa from Indian Ocean (Taylor, 1976), 21 taxa from Caribbean Sea (Wood, 1968) and 30 taxa from the Mediterranean Sea (Gomez, 2003) belonging to this genus are valid.

Gonyaulax pacifica Kofoid 1907

This is a distinctive, very large and highly flattened species. The flattening of the cell is asymmetrically dorso-ventral. The cell size ranges in length from 115 to 167 µm, similar to *Gonyaulax kofoidii* Pavillard but, larger than *G. kofoidii* (Taylor, 1976). Moreover, the population of theca in *G. pacifica* is delicately developed and widely spaced. The broad intercalary bands are usually present between the apical and precingular plates (Figure 2).

This species is distributed in warm temperate to tropical waters in the Indian, Pacific and Atlantic Oceans and the Mediterranean Sea.

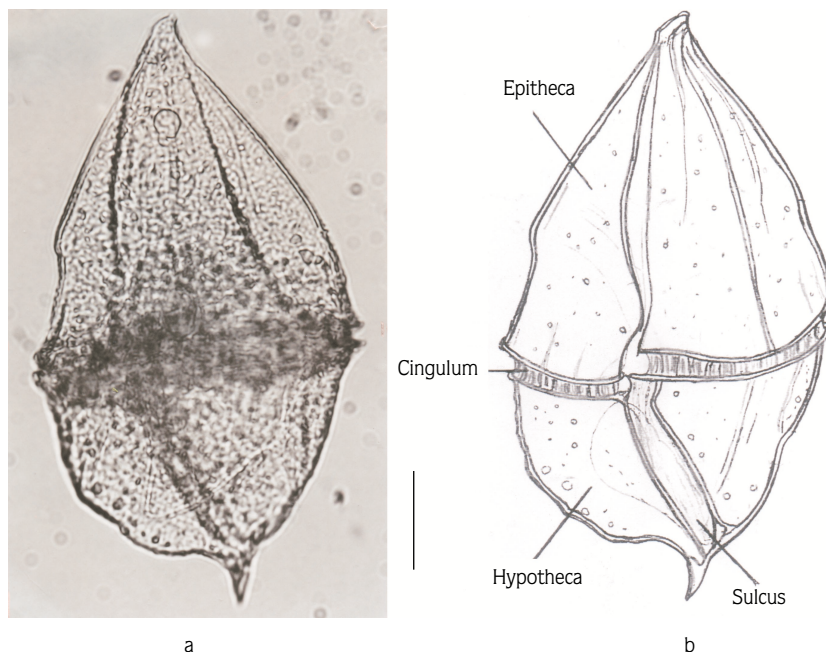


Figure 2. a) Light microscopy photograph of *Gonyaulax pacifica*.
b) The detail of cell structure (Scale 20 μm).

G. pacifica was reported from different sub basins of the Mediterranean Sea (Rampi & Bernhard, 1980; Gomez, 2003), but there is no record for Turkish Seas (Koray et al., 1999; Koray, 2001). Because of its rare occurrence, this species may have been neglected in previous studies carried out in the northeastern Mediterranean (Polat et al., 2000; Eker & Kideys, 2000). However, another possibility is that this species may have recently been transported to the eastern Mediterranean coast of Turkey.

The biogeographic distribution of plankton is affected by many factors. Hydrographic processes such as current systems are main factors in the transportation of the species. Exchange through the Strait of Gibraltar can be considered the main source of species to the Mediterranean Sea. Likewise, seawater circulation through the Strait of Gibraltar and surface Atlantic water inflow, favours the entrance of Atlantic species to the Mediterranean Sea (Gomez et al., 2000). On the other

hand, the northward migration of Red Sea/Indian Ocean species through Suez Canal appears to have been accelerated during the past few decades by a rise in the sea temperature as well as by the construction of Aswan Dam, leading to more oligotrophic conditions on the Mediterranean side of the canal. The increase of temperature and salinity in the Mediterranean Sea could facilitate the growth of introduced Red Sea and tropical Atlantic species (Gomez, 2005). In addition to the Red Sea and Atlantic migrants introduced by hydrographic processes, species are introduced into the Mediterranean via marine vessels as a result of increased marine traffic. Due to the effects of all these factors, changes are observed in recent decades in diversity of phytoplankton of the Mediterranean Sea.

For these reason continuous and detailed studies should be conducted to determine the changes of diversity in such marine environments which has special conditions as Mediterranean Sea.

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