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Bloom event of *Leptocylindrus danicus* along the Northeastern Mediterranean coast: a case study from Arsuz-Konacık

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ABSTRACT

Leptocylindrus danicus, a meroplanktonic marine diatom species belonging to the Bacillariophyceae class, is widespread along the northeastern Mediterranean coast. Despite its global distribution, records of blooms associated with this species are pretty limited. Finding the causes of the noticeable sea foam formation and reddish-brown discoloration that were noticed along the Arsuz-Konacık (Hatay-İskenderun) coastline on July 22, 2025, is the aim of this study. Microscopic examination of seawater samples taken from various sites during this event, which impacted a 10-kilometer coastal area, showed the presence of a bloom of the *L. danicus*. Cell density varied between 1.4×10^5 and 2.1×10^5 cells per liter, according to the cell count data. The abundance determined is the first recorded bloom of *L. danicus* from the Northeastern Mediterranean. Increased seawater temperatures resulting from global warming, along with nutrient inflows to the region, may have contributed to the species' overpopulation.

Keywords: First report, *Leptocylindrus danicus*, bloom, Arsuz-Konacık, Northeastern Mediterranean Sea

1. INTRODUCTION

As the primary producers of the marine food chain, phytoplankton not only provide oxygen and nourishment to higher trophic levels, but they may also be capable of mitigating the effects of global warming by absorbing carbon from the atmosphere. These single-celled creatures are found throughout the ocean's photic zone and have the ability to photosynthesize. It has been demonstrated that alterations in physical parameters—such as temperature, salinity, dissolved oxygen levels, pH, and light penetration—and in chemical components, including nutrient salt (nitrate, phosphate, silicate) concentrations and dissolved inorganic carbon levels, significantly influence seawater's physical and chemical properties. These factors can cause an undesirable increase in plankton abundance locally (Nashad et al., 2017). The most obvious cause of plankton overgrowth is changes in nutrient abundance.

It has been shown that phytoplankton blooms have detrimental effects on the quantity and quality of water, including increased turbidity, decreased light penetration, hypoxia caused by low dissolved oxygen levels, and the emergence of eutrophication processes that endanger the lives of fish and other marine life (Smayda, 2006; Dorgham, 2013; van Beusekom, 2017). Additionally, phytoplankton blooms have been reported to cause excessive CO2 accumulation in seawater due to increased respiration, which in turn causes acidification and changes in the carbonate chemistry of the seawater (Flynn et al., 2012; Riebesell et al., 2018).

While certain plankton blooms have been shown to exert deleterious effects on marine ecosystems (Hallegraeff, 2010), blooms originating from specific species such as *L. danicus* have been determined to be non-toxic (Nashad et al., 2017).

L. danicus is a species of phytoplankton that belongs to the Bacillariophyceae (diatom) class. It is distributed in temperate waters of oceans and seas. Species of the Leptocylindrus genus are known to occur in the Mediterranean Sea. This species, a siliceous algae, can occur singly or in colonies, forming long, rectangular chains (Zingone et al., 2010). Zingone et al. (2006) reported that *L. danicus* reaches high abundance throughout the water column during the summer months, when water temperatures and light intensity are high, due to increased nutrient levels. This results in foam formation and color changes due to increased organic matter in seawater.

In the northeastern Mediterranean, bloom events involving the epipelagic octopus species *Tremoctopus violaceus* and the small jellyfish *Pelagia noctiluca* have been reported (Montesanto et al., 2022). There have been prior reports of *L. danicus* blooming along the southeast coast of India (Thillai et al., 2010), off the South Andaman Islands (Karthik et al., 2017), and along the southeast coast of the Arabian Sea close to the Kerala coast (Nashad et al., 2017). This study is the first bloom record of *L. danicus* observed along the Arsuz-Konacık coastline in the northeastern Mediterranean.

Fig. 1. Map showing the location of the bloom event.

2. MATERIAL AND METHODS

On July 22, 2025, seawater samples were taken from various locations along a 10-kilometer section of the Arsuz-Konacık coastline in the Hatay-İskenderun region. During this investigation, foam formation and a reddish-brown discoloration of the seawater were observed.

Surface water samples were collected from five different locations in this area. The location of the sampling area is depicted in Map 1 (Fig. 1). Surface water samples were collected using a scaled container and transferred to the laboratory in 1-litre sample containers containing a formaldehyde-buffered solution (Fig. 2). In the laboratory, sample analyses were conducted using a Sedgwick-Rafter counting chamber and a light microscope for phytoplankton counting. The species-level identifications were based on the taxonomic monograph that was prepared by Tomas in 1997.

Fig. 2. Seawater sample collected from the bloom-affected area.

3. RESULTS AND DISCUSSION

On July 22, 2025, the coast of Arsuz-Konacık (Hatay-İskenderun) saw the first *L. danicus* bloom ever seen in the Northeastern Mediterranean. The water turned brown-red and the surface began to foam intensely in the seawater area where the species overpopulated (Fig. 3 & Fig. 4).

Fig. 3. Reddish-brown discolouration of seawater observed during the bloom.

The coagulation mechanism has been shown to play a major role in the natural removal of excessive algal accumulation in eutrophic environments (Jackson & Lochmann, 1992). The aggregation and subsequent settling of phytoplankton cells, driven by physicochemical processes, play a key role in facilitating the removal of biological material from the seawater (Jackson, 1990; Ullal et al., 2001; Nashad et al., 2017).

Fig. 4. Foam formation observed in seawater during the bloom event.

Following detailed microscopic examination, the species responsible for the bloom was identified as *L. danicus* (Fig. 5). The cell density of this species in the sampled seawater ranged from 2.1×10^5 to 1.6×10^6 cells/L. A comparable bloom event was documented on 11 November 2014 along the Kerala coast in the southeastern Arabian Sea (Nashad et al., 2017). In this study, the cell density of *L. danicus* was determined to be 1.5×10^5 – 1.8×10^5 cells/litre from the coast towards the open sea.

Seasonal changes in water temperature and current systems, intensive agricultural practices, and related terrestrial discharges could be the main causes of the excessive abundance of *L. danicus* along the Arsuz coast. Additionally, it is predicted that the Eastern Mediterranean's growing eutrophication trends since 2010 will promote the recurrence of these bloom events (Tzortziou et al., 2012).

It has been established that there were no fish deaths as a result of the *L. danicus* bloom along the Arsuz coast. Non-toxic algal blooms (non-toxic HAB) are typically defined as the high-density proliferation of diatom-class species like *L. danicus*. It is unknown whether this species is capable of producing toxins. Nonetheless, it has been shown that an overabundance of cells can cause the dissolved oxygen content of the marine environment to drop sharply. Due to increased respiratory activity during the night, this condition may worsen and possibly put fish and other aquatic life under physiological stress.

Furthermore, the polysaccharide structures released by *L. danicus* into the extracellular environment, known as extracellular polymeric substances (EPS), has been observed to increase foaming on surfaces and create aesthetic pollution in coastal areas (Wurl & Holmes, 2008).

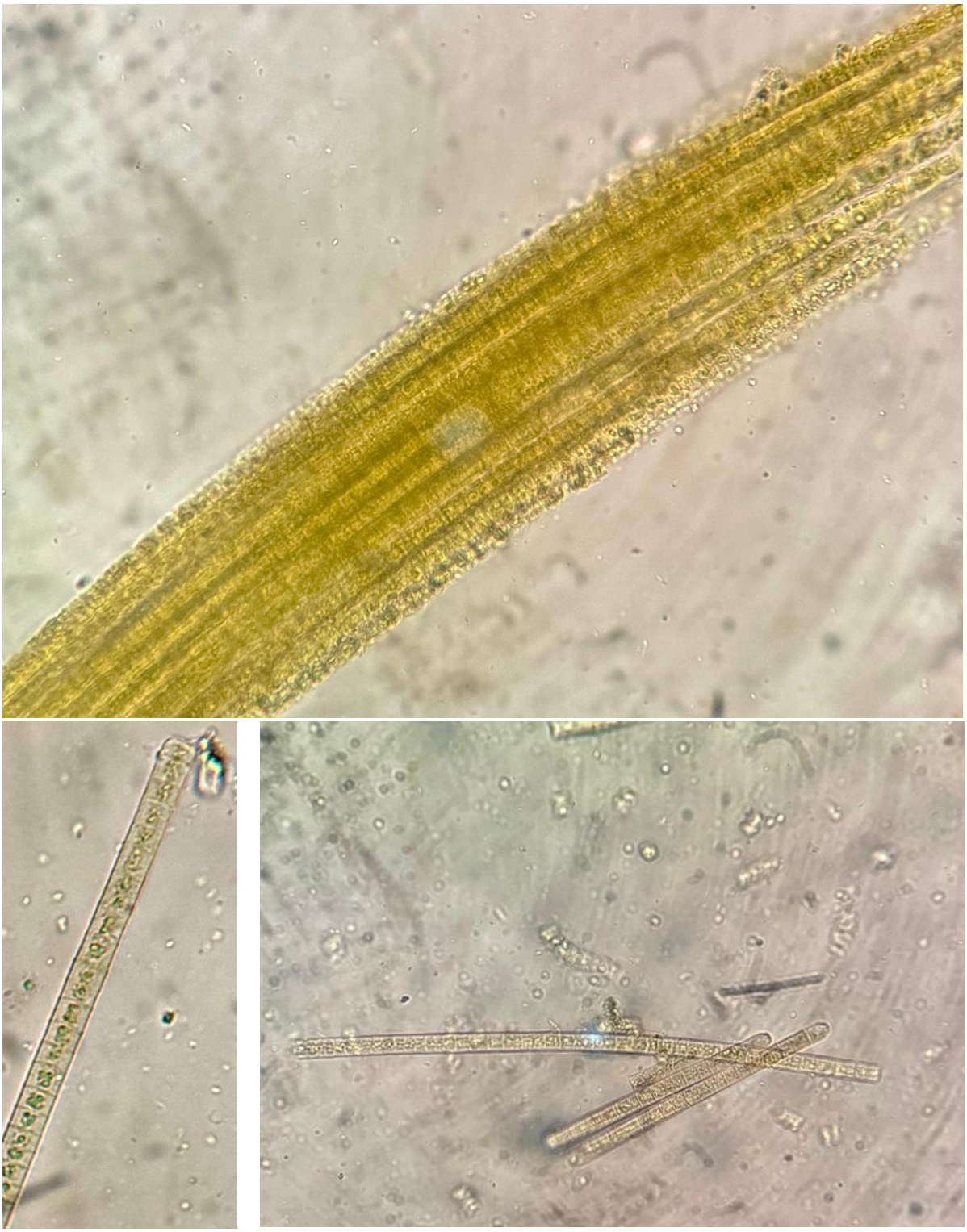

Fig. 5 Microscopic images of *L. danicus* sampled from Arsuz coasts

4. CONCLUSION

This event, observed along the Arsuz coastline, constitutes a regional phytoplankton bloom, with *L. danicus* identified as the dominant species. Although this species has been previously observed in the eastern Mediterranean, the cell densities recorded in the present

study, in conjunction with the associated discolouration of the seawater and the formation of foam, are documented here for the first time.

Since plankton blooms can benefit from favorable environmental conditions created by shifting seawater temperatures and current directions brought on by global warming, such events are likely to happen more frequently. Protecting marine biodiversity requires regular monitoring of shifting environmental conditions and the creation of preventative measures.

Authors contributions

All authors contributed to writing and editing the article. NÇ led the investigation, conceptualization, and the writing of the original and final draft. DA helped in the sampling of materials, reviewing, and editing of final draft.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Not applicable.

Ethical approval & declaration

In this article, as per the algae regulations followed in the Mersin University, Faculty of Fisheries, Mersin, Türkiye; the authors observed the bloom event of *Leptocylindrus danicus* along the Northeastern Mediterranean coast, Arsuz-Konacık. The ethical guidelines for algae are followed in the study for species observation, identification & experimentation.

Data and materials availability

All data associated with this study are present in the paper.

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