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Short Communication

First records of *Bolinopsis vitrea* (L. Agassiz, 1860) (Ctenophora: Lobata) in the Black Sea

Bayram Öztürk[1], Vesselina Mihneva[2] and Tamara Shiganova[3]*

[1]*Faculty of Fisheries, University of Istanbul, Istanbul, Turkey*
[2]*Institute of Fishing Resources, Varna, Bulgaria*
[3]*P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russian Federation*

E-mail: ozturkb@istanbul.edu.tr (BO); vvmihneva@yahoo.com (VM); shiganov@ocean.ru (TS)

**Corresponding author*

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Abstract

The ctenophore *Bolinopsis vitrea* is first reported from the Turkish and Bulgarian regions of the Black Sea. In Turkish waters, a considerable aggregation was found in Sile on the Asian side and at Kilyos on the European side in 2007. This appears to be the first record of this species in the Black Sea, which is known in the Mediterranean Sea including the Aegean Sea. *Bolinopsis vitrea* most likely penetrated with currents from the Aegean Sea via the Sea of Marmara into the Black Sea. In 2010 individuals of this species were recorded at two locations in Bulgarian waters where it may have entered with currents or else was released with ballast water.

Key words: Ctenophore, *Bolinopsis vitrea*, Black Sea, Mediterranean

Until recently, species of Mediterranean origin have been recorded either temporarily or permanently in the Black Sea, mainly near the Bosphorus area but are rarely considered as established non-native species. Now however, some Mediterranean species of phytoplankton, zooplankton, benthic and fish species have been encountered also in the northwestern and northeastern Black Sea (Shiganova and Ozturk 2010). This process of adaption of Mediterranean biota was most probably facilitated by rising seawater temperatures and increasing shipping intensity. Mediterranean species have reached the center, southwestern, southeastern and northeastern regions carried by the currents or by Mediterranean water plumes or possibly ship transported. The number of species brought with ballast waters has increased especially around harbor areas. Some species have been represented by only a few recorded specimens; others with high abundance (Alexandrov 2004; Boltachev 2006; Selifonova 2009; Shiganova and Ozturk 2010).

The process of the establishment of Mediterranean species that have already invaded into the sea is also proceeding. Selected species of this kind may temporarily become subdominant species. But, as a rule, most of phyto- and zooplankton species remain rare or are abundant only in definite years (Alexandrov 2004; Vershinin et al. 2005). It means that conditions of the Black Sea with low salinity and low winter temperature do not favor maintenance of self-sustaining population of the most of these species. During the past few years a new tendency has appeared – with gelatinous species expanding from the Mediterranean, first into the Sea of Marmara then into the Black Sea. The increase of the numbers of species, abundances and areas of distribution of gelatinous plankton both native and invaders are the main concern for the Mediterranean, Sea of Marmara and Black Sea ecosystems (Shiganova and Ozturk 2010).

In the Black Sea, the single native ctenophore species is *Pleurobrachia pileus* (O.F. Müller, 1776). During the last three decades two North American ctenophore species were unintentionally introduced into the Black Sea (Vinogradov et al. 1989; Konsulov and Kamburska 1998). Firstly the zooplanktivorous *Mnemiopsis leidyi* (Agassiz, 1865) arrived, affecting all trophic

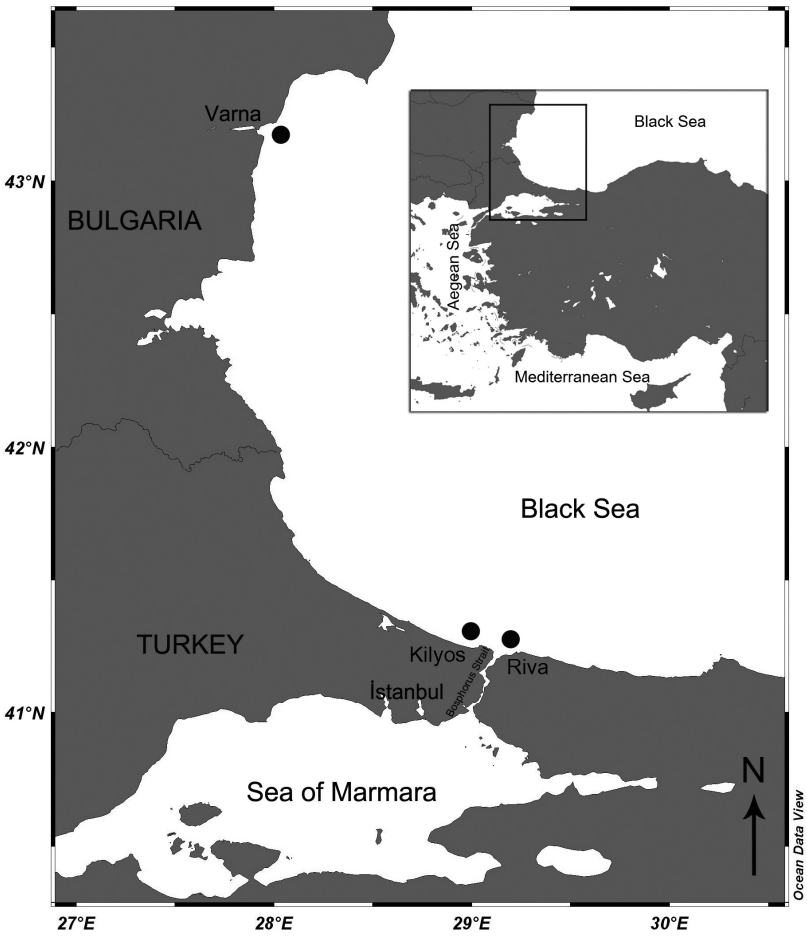

Figure 1. Areas of *Bolinopsis vitrea* observations in the Black Sea.

levels (Shiganova 1998), followed a decade later by its predator *Beroe ovata sensu* Mayer 1912 and subsequently the ecosystem began to recover due to the sharp drop of *M. leidyi* abundance (Shiganova et al. 2004a). Arrival and establishment of two warm water ctenophores coincided with a time of eutrophication and a warm period in the Black Sea.

In this paper we report the first Black Sea records of lobate ctenophore *Bolinopsis vitrea* (L. Agassiz, 1860), discuss the possibility of its establishment and assess this event as part of the ongoing process of the appearance and establishment of Mediterranean species in the Black Sea.

In November 2007, while diving in the coastal waters of Kilyos and Riva in the Turkish part of the Black Sea (Figure 1), one of the authors (BO) observed several individuals of the lobate ctenophore species of the genus *Bolinopsis* (Figure 2, 2B). This aggregation was recorded for the first time on 5 November 2007 in Kilyos (41°15′N, 29°01′E). Another aggregation was observed on 19 November 2007 at the coasts of Sile (41°11′N, 29°05′E) and Riva (41°21′N, 29°03′E). Both aggregations consisted of at least five individuals, ranging from 24 to 116 mm in total length. The underwater photographs of the aggregations were taken and specimens were identified as *Bolinopsis vitrea*. The location depth was 5–6 m. The area in Kilyos is just at the exit of the Istanbul Strait (Bosphorus) (Figure 1, 2) and no other ctenophores similar to this species occur in the Black Sea. The other area of *Bolinopsis* findings was off Sile, at a depth of 80 m, which is 30 nautical miles away from the Istanbul Strait. The observation depth was also 5–7 m. These individuals of *B. vitrea* could enter the Black Sea with strong currents driven by southern winds and were carried from the south to the west. The surface water of the

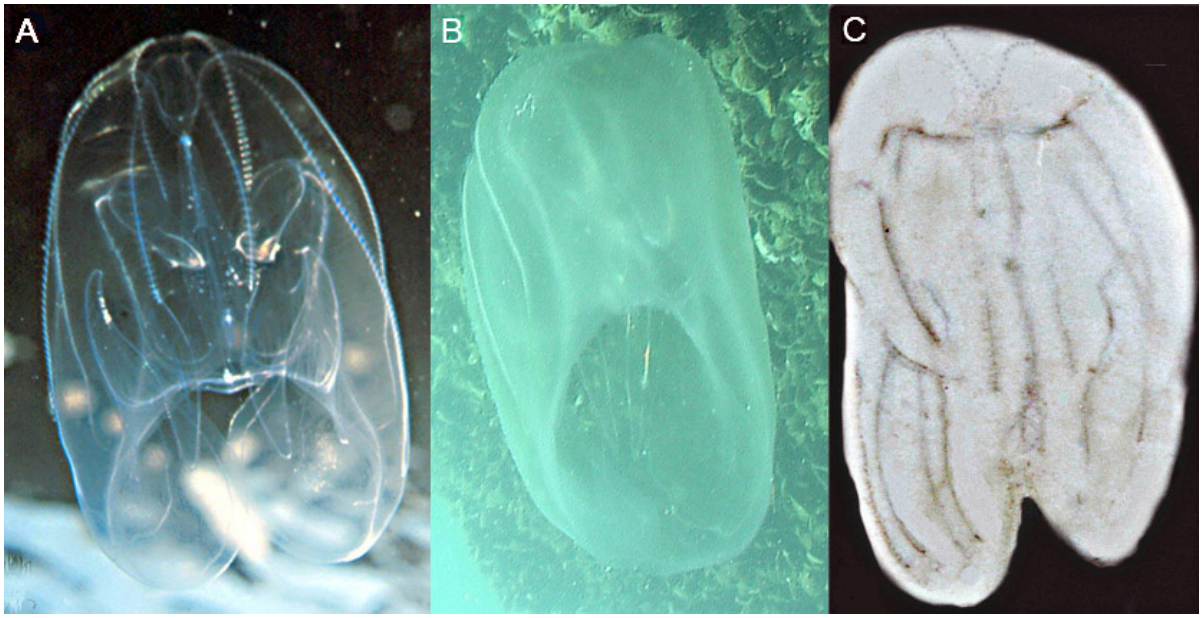

Figure 2. View of *Bolinopsis vitrea* from Mediterranean Sea (**A**, photograph by M. Richter), from Sile, Turkey (**B**, photograph by B.Öztürk), and from Bulgarian coastal waters (**C**, photograph by V. Mihneva).

Black Sea flows into the Marmara Sea, then towards the direction of the Aegean Sea; on the other hand, the saline waters of the bottom currents in the Istanbul Strait transports Mediterranean organisms into the Black Sea. These two-current systems partly control faunal exchange within the basins. Inevitably, the Istanbul Strait is also named an ecological barrier, a biological corridor and an acclimatization zone for the biota of two basins, favouring some of the Mediterranean origin species penetrating into the Black Sea (Öztürk and Öztürk 1996).

In September 2010, representatives of genus *Bolinopsis* were recorded in two locations in Bulgarian waters by another author (VM) (Figure 2C). Two large specimens of *B. vitrea* (~ 50 – 55 mm) were observed 1 mile offshore of Cape Kaliakra, (in an area of 30 m depth, 43º17′N, 28º13′E), sampled in the surface 5 m layer by a Bongo net) and 10 miles off the Cape Galata (in an area of 50 m depth, 43º30′N, 28º49′E), sampled from the surface 10 m layer). The state of these specimens were not good because they were collected by this net (there were also many specimens of *Beroe ovata* and *Aurelia aurita* in the samples).

According to morphological features, they were identified as *Bolinopsis vitrea,* and could have been carried by advection currents or brought with ballast waters from the Mediterranean Sea. It is distinguished from the Arctic pear-shaped *Bolinopsis infundibulum* by possessing a wider oval body shape with relatively longer oral lobes (3/4 of body, while *B. infundibulum* lobes comprise 1/3 of the body). *B. vitrea* has much simpler windings of the meridional vessels in the oral lobes (Mayer 1912).

Bolinopsis vitrea can also be easily distinguished morphologically from *M. leidyi* (Figure 3). Although both species have an oval body with considerable lateral compression, two oral lobes are derivatives of the ctenophore body (spherosome). Four smaller lobes-auricles are situated under two principal oral lobes. The main difference between these two species is the position of the oral lobes. In *M. leidyi*, the oral lobes originate near the level of infundibulum, whereas in *B. vitrea* they originate approximately half-way between the mouth and the infundibulum. In addition, *M. leidyi* often has papillae (warts) on the body while *B. vitrea* does not (Shiganova and Malej 2009).

Bolinopsis vitrea is widely distributed in subtropcial waters (Harbison et al. 1978). This species also occurs in the eastern and western Mediterranean, including the Aegean and Adriatic Seas (Artüz 1991; Mills et al. 1996;

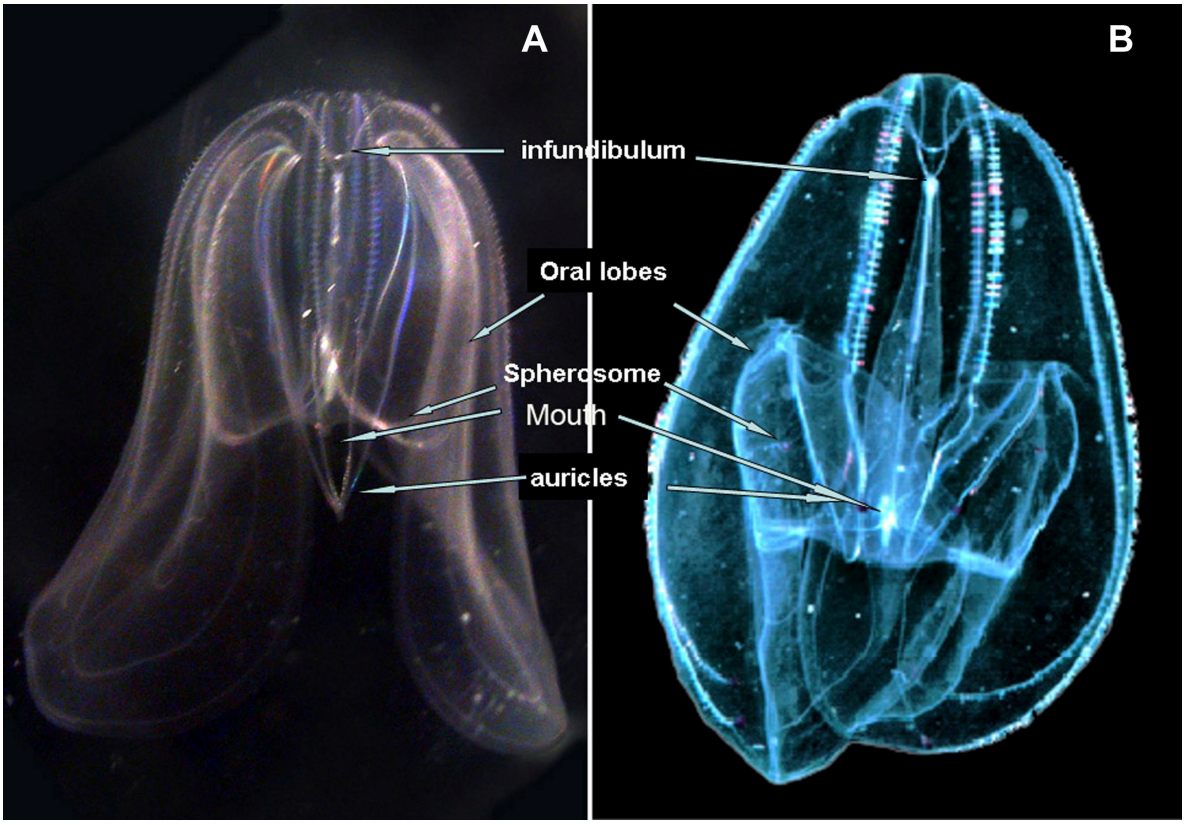

Figure 3. Morphological differences between *Mnemiopsis leidyi* and *Bolinopsis vitrea* (photographs by T. Shiganova and Marjan Richter).

Shiganova et al. 2004b; Shiganova and Malej 2009). *B. vitrea* seems to prefer warm, shallow waters. It feeds on zooplankton, eggs and small larvae of fish (Kremer et al. 1986). *Bolinopsis vitrea* was not abundant in the Mediterranean (Shiganova et al. 2004b) until recently.

Therefore there were no recorded impacts of *B. vitrea* on the zooplankton stocks and anchovy eggs and larvae in the Northern Aegean Sea in 2001 and no blooms have been recorded in the Aegean Sea until recently (Shiganova et al. 2004b). During recent years its population size has increased in some coastal areas of the Mediterranean Sea such as the Spanish coastal waters of the lagoon of Mar Menor (western Mediterranean) (pers.com. L. Prieto) and in the southern Adriatic (D. Lučić, pers. comm).

Increasing abundance of *B. vitrea* could be facilitated by rising water temperatures both in the Mediterranean and Black Seas. We cannot consider *B. vitrea* as an established species but it poses impacts on the Black Sea biodiversity in the case of its establishment. It also may become a competitor of the invader *Mnemiopsis leidyi*. The first records of the Mediterranean species *Bolinopsis vitrea* is one more evidence of new tendency, which has been noticed during recent years, i.e, the arrival of gelatinous species from the Mediterranean into the Black Sea, most probably due to rising temperature in both areas. Recently several Mediterranean jellyfishes penetrated first to the Sea of Marmara. Among them were scyphomedusae *Chrysaora hysoscella* (Linnaeus, 1766), *Cassiopea andromeda* (Forskål, 1775), *Paraphyllina ransoni* Russell, 1956, trachymedusa *Liriope tetraphylla* Chamisso and Eysenhardt, 1821 and three hydromedusae *Aglaura hemistoma* Péron and Le Sueur, 1810, *Neoturris pileata* (Forskål, 1775), *Solmundella bitentaculata* (Quoy and Gaimard, 1833) (Ozgur and Ozturk 2008; Öztürk and Topaloglu 2009; Isinbillir et al. 2010).

In 2009 *Chrysaora hysoscella* was recorded for the first time in the Istanbul Strait and Turkish part of the Black Sea (Öztürk and Topaloglu 2009). This is a temperate planktivorous species and therefore we cannot exclude the possibility of *C. hysoscella* establishing in the Black Sea, particularly with favourable conditions in terms of prey crustacean zooplankton, if it can tolerate the low salinity level.

Thus, there is a progressive trend of the arrival of Mediterranean species into the Black Sea, both with the currents as natural expansion and with ballast waters. Most of these species had arrived in previous years also, but relatively low temperatures and low salinity may have prevented their establishment. Now with the temperatures rising, probably followed by the change in environmental conditions, species with high environmental tolerance may establish in the Black Sea. Another possible reason could be the intensification of shipping particularly between the Mediterranean and Black Sea countries. Since 2000, 62% of vessels arrived in Novorossiysk harbour from the Mediterranean countries (Matishev et al. 2004). The number of species released with ballast waters has increased. Some of these species have begun to establish in the near ports areas (Selifonova 2009; Shiganova and Ozturk 2010). First of all benthic species that inhabit depths where salinity is higher have become successful colonizers especially in the southern Black Sea (Sergin and Kideys 2010; Milchakova 2002).

The total number of Mediterranean species found only in the southern Black Sea is 240 species (Shiganova and Ozturk 2010). At the present time it is difficult to determine exactly how many of them might be included in the list of established species. This process is ongoing and probably we have not taken into account some species, which were recorded recently and locally.

Not all non-native Mediterranean species are harmful for the Black Sea ecosystem with the exception of gelatinous species. Expansion of gelatinous species from the Mediterranean to the Sea of Marmara and further to the Black Sea is a particular threat for the ecosystems. We may conclude that penetration of a new species, such as a lobate ctenophore *Bolinopsis vitrea,* to the Black Sea may be an additional signal of the expansion of Mediterranean species into the Black Sea due to anthropogenic and climatic changes. It should be monitored by determining all similar records and to have reliable data to create risk assessment which species could establish and create self- sustaining population and to determine their patterns of dispersal in the Black Sea.

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