



**- SHORT COMMUNICATION -**

**A most northern record of alien tunicate *Phallusia nigra* Savigny, 1816, population from the Argolic Gulf, Greece**

Panagiotis Latsoudis\*

The Moraitis School, Gymnasium, Psychiko, Greece.

**Abstract**

The black tunicate *Phallusia nigra*, Savigny, 1816 (Ascidiacea) is considered an alien species that has colonized the Levantine Sea. During a littoral zone search in July 2019 into the Porto Heli Bay (Argolid Peninsula, Peloponnese, Greece), a well-established population of the species was observed on a floating jetty. A large number of individuals (more than 50) suggests that the species is recently expanding its distribution into the northern and western part of the East Mediterranean Sea, after 67 years of occurrence in the Mediterranean Sea.

**Keywords:**

Argolic Peninsula, *Phallusia nigra*, Alien species, Ascidian, Greek waters

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**Introduction**

The black tunicate *Phallusia nigra*, Savigny, 1816 (Ascidiacea) is considered an alien species in the Mediterranean Sea that originated from tropical seas (Vandepas et al., 2015). The first record of the species into the Mediterranean Sea was in 1952 (Pérès, 1958). It is also the first non-indigenous ascidian reported in Greek waters, into the area of Rhodes Island to the southeastern most of the country (Kondilatos et al., 2010). The species has colonized the Levantine Sea (Çinar et al., 2006 ; Izquierdo et al., 2009 ; Zibrowius & Bitar, 2003). In 2008, only one casual specimen of *P. nigra* has been found at Peristera Island in Chalkidiki (North Aegean Sea) where it appears to be very rare (Koutsogiannopoulos et al., 2012).

The genus *Phallusia* Savigny, 1816 belongs to the family Ascidiidae (Shenkar et al., 2020) and the wider group of ascidians (Phylum Chordata, Class Ascidiacea) that forms the largest and

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\* Corresponding author, Panagiotis Latsoudis E-mail: [PLatsoudis@moraitis.edu.gr](mailto:PLatsoudis@moraitis.edu.gr)

most diverse class of the sub-phylum Tunicata with approximately 3000 described species found as sessile animals -in their adult stage- in all marine habitats (Shenkar & Swalla, 2011).

The *Phallusia nigra* species is a solitary ascidian, with a striking smooth black tunic usually devoid of epibionts, and a large size, up to 10 cm, living in tropical waters at shallow depths on hard or rocky substrates, and is very common on artificial substrates (Vandepas et al., 2015). It was formerly placed in the genus *Ascidia*, *Phallusiopsis*, *Thallusia* and *Tunica* (Shenkar et al., 2020). Its native range is considered the tropical Western Atlantic Ocean (Eldredge & Smith, 2001). Along with this, the Red Sea and the Indo-Pacific Ocean are also referred as its' potential native origin (Ulman et al., 2017).

In our days the global climate warming favors the settlement of new alien species at an unexpectedly rapid rate (Raitsos et al., 2010). On the other hand, the potential invasive nature of the ascidians and their ability to thrive in eutrophic environments (Shenkar & Swalla, 2011) could be the reason for the expansion of their range in eutrophic seas enriched with minerals and nutrients from anthropogenic sources. So, we could expect that a species like *Phallusia nigra* will extend its range into the near future all the Mediterranean Sea.

The present study, reports a well-established population of *Phallusia nigra* in the littoral zone of mainland Greece, further ahead its' former distribution range.

### Material and methods

A surface snorkeling search was conducted into the littoral zone of the Porto Heli Bay (Peloponnese, Greece) (Fig.1) on July 2, 2019. This is a well-protected bay with a seaside resort town and a very busy boatyard. Specimens of large solitary pure black and slick tunicates were noticed on a floating jetty (Fig.2). The study area is located about 25 meters from the shoreline ( $37^{\circ}19'25.9''\text{N}$ ,  $23^{\circ}09'17.9''\text{E}$ ), well away from the intertidal zone. Sea surface temperature was  $25^{\circ}\text{C}$  on the day of observation and all individuals were observed in a depth of about 50 cm.

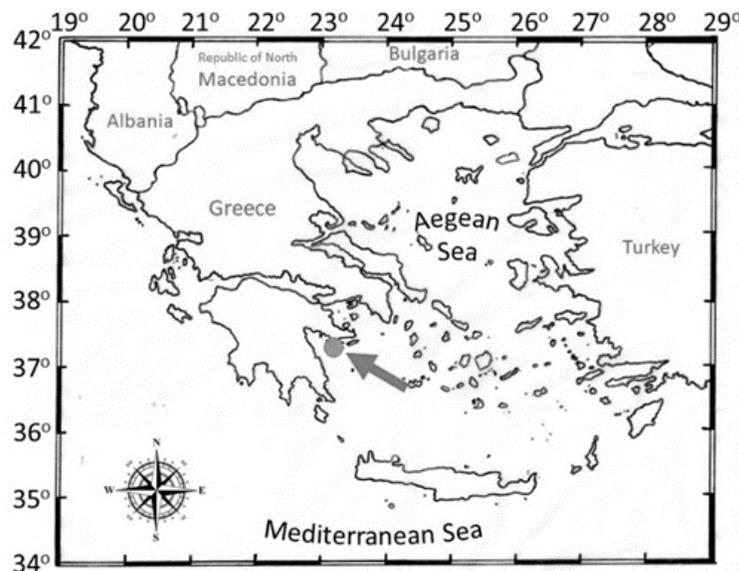


Figure 1. The map of sampling location, within the cycle (Porto Heli Bay, Greece).



Figure 2. A large (~8.5 cm) individual of *Phallusia nigra* from Porto Heli Bay.

Other organisms of the dock's epifauna included European flat oyster *Ostrea edulis*, branching bryozoan *Schizoporella errata*, and black sea urchins *Arbacia lixula*.

## Results

More than 50 individuals of pure black tunicates were attached to the submerged bottom surface of the floating jetty. Larger individuals measured up to ~9 cm of total body length. Even though the black tunicate *P. nigra* is considered an easily recognized species (Van Name, 1945), a recent study concludes that there are at least three similar species worldwide (*P. nigra*, *P. philippinensis*, *P. fumigata*) with dark black tunics (Vandepas et al., 2015). The first list of all marine species in Europe (Monniot, 2001) mentions the presence of both *P. nigra* Savigny, 1816, and *P. fumigata* Grube, 1864 into the Mediterranean Sea. *P. nigra* always has a smooth and opaque blue-black tunic without encrustations, short atrial siphon, and long, curved oral siphon. *P. fumigata* has dark, brownish, or grayish pigmentation only in exposed parts and, typically, found attached inside crevices (Vandepas et al., 2015).

All the individuals observed had a pure black and smooth tunic and a totally exposed body (Fig. 3) combining an identical set of morphological and behavioral characteristics of the species *P. nigra*.



Figure 3. Pure black and smooth tunic surface of a specimen from Porto Heli Bay indicating it belongs to the *Phallusia nigra* species.

## Discussion

The Argolic Gulf is not only a new location for this alien marine animal. The high number of individuals and their dense population suggest the establishment of the species into the area. This location is more than 400 km northwest from the first documented record in Greece and well away from the Levantine coasts, where it was known to exist until now (Fig. 4).



Fig. 4. First confirmed year of *Phallusia nigra* occurrence in different parts of the Eastern Mediterranean Sea (based on: Çinar et al., 2006 ; Kondilatos et al., 2010 ; Koutsogiannopoulos et al., 2012 ; Pérès, 1958 ; Zibrowius & Bitar, 2003 and the present study).

The gradual expansion of exotic warm water species of tropical origin is probably correlated with the recent sea temperature rise due to the climate change (Darmaraki et al., 2019; Sakalli, 2017; Turan et al., 2016). On the other hand, the artificial substrate were the species located as well as the boating traffic in this area could indicate that the anthropogenic habitat disturbance and the hull-fouling vector in particular, is another driving force for its expansion (Lambert, 2002).

Our findings suggest that the species is expanding its distribution into the northern and western part of the East Mediterranean Sea which is adding on the concerns about the probable impact of invasive ascidians into the native biota (Lambert, 2002). We speculate that a future increase in the numbers could cause some economic impact in shipping and other marine operations due to their biofouling nature (Lambert, 2002). Conversely, it is also known that many ascidians produce noxious secondary metabolites to avoid predation and fouling (Shenkar & Swalla, 2011) and antimalarial compounds have been already isolated from *Phallusia nigra* (Mendiola et al., 2006). Along with its' ability to leave on artificial substrates and eutrophicated waters, we could assume that in the future it is possible to take economical advantage of the species into the Mediterranean Sea.

It could be important to design further studies for the monitoring of the species and to clarify the extant cause or combination of causes of this species' expansion.

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**Conflict of Interest:** The author declares that he has no conflict of interest.

**Ethical approval:** All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

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