Emergent Marine Toxins in Europe: is there a new Invasion?

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Introduction

Episodes of human intoxications due to Harmful Algal Blooms have been common in the last century mostly due to the fact that these events were not regularly monitored. In Portugal, fatal occurrences linked to the consumption of bivalves contaminated with Paralytic Shellfish Toxins-PSP [1] led to the establishment of a national monitoring program for these types of toxins that started in 1986. Later, the compulsory monitoring of ASP and DSP followed the international regulations and the local detection of the toxins causing the intoxications [2,3]. Nowadays, the cases of human intoxications are sporadic and are due usually to the disrespect of harvest and consumption prohibitions launched by national health authorities.

The occurrence of other toxins of marine origin in north Atlantic coastal waters has been sporadically reported and usually this occurs following a human intoxication episode. In 2007, a Spanish man that consumed a gastropod of the genus Charonia collected in the south of Portugal (Algarve) was severely intoxicated and needed hospital care [4]. Analysis of the suspected specimen revealed the occurrence of tetrodotoxin (TTX) and 5,6,11-trideoxyTTX analogue, in amounts that were high enough to cause the intoxication [4].

The first report in Europe on the occurrence of Gambierdiscus sp. potential producer of ciguatoxin (CTX) was in Crete in 2003 [5]. Latter, the intoxication of fishermen that have eaten some fish caught off the Madeira island archipelago revealed the presence of CTX [6]. Palytoxins (PTX) have been originally detected in marine zoanthids (soft corals) of the genus Palythoa, but thereafter the production of several analogs was also confirmed in benthic dinoflagellates of the genus Ostreopsis (e.g. Ostreopsis siamensis, O. mascarenensis, O. ovata). PTXs were first reported in Hawaii and Japan, in warm waters the soft corals naturally occur, but are currently known to be distributed worldwide [7,8], especially after the uncovering of the broad distribution of Ostreopsis spp. Actually, blooms of Ostreopsis spp. have also been reported in European countries [9,10], such as in France, Greece, Italy and Spain. Recently, a bloom of Ostreopsis spp. on the coast of Algarve (south of Portugal) showed that species capable of producing palytoxin analogues such as ovatotoxin may be spreading from the Mediterranean to the north Atlantic [11]. Other recent study [12] highlights a less obvious dispersal route for PTX (although at its most productive forms-those produced by zoanthids), which is the one derived from home aquarium trade. It emphasizes the danger of these organisms which may pose to saltwater aquarium enthusiasts. In fact, some poisonings have already been reported [8]. As can be observed in specialized web forums, there are anecdotal evidences of the exposure to these soft corals by aquarium hobbyists from Portugal.

The amino acid β-N-methylamino-L-alanine (BMAA) has been linked to neurodegenerative diseases [13]. Biomagnification of BMAA through trophic chains was first proposed for the Guam ecosystem and showed the presence of BMAA from the endosymbiotic cyanobacteria Nostoc sp. (on the coralloid roots of Cypax) [14]. Recently, biomagnification of BMAA in food webs of the western North Atlantic has been shown, from cyanobacteria, to zooplankton, to invertebrates, and to vertebrates (fish) with increasing BMAA concentration within higher trophic levels [15,16].

All these episodes clearly show that tropical and subtropical marine toxins may be spreading their geographical distribution and the eastern North Atlantic area of the Portuguese waters is being affected. The causes may be multiple, such as global climate changes, new vectors, increased impact of the Suez channel on the Mediterranean and east north Atlantic biological diversity or ballast waters. In fact, in the Mediterranean Sea the eutrophication is a current phenomenon and this may work as a seed bank for the establishment of subtropical organisms in the eastern north Atlantic area. We detected TTX and several analogues in three autochthonous gastropod species of the north Atlantic Portuguese continental coast by using LC-MS/MS and UPLC-MS/MS [17]. TTX, 4-epiTTX, monodeoxyTTX and 5,6,11-trideoxyTTX were detected in Monodonta lineata, Gibbula umbilicalis and Charonia lampas, being the most northern point of the Atlantic Ocean were these toxins were reported. All these species are edible raising the probability of human health hazards. Despite of the low concentrations detected, ranging from 6.22 to 90.50 ng/g, this clearly show that TTX and analogues should be monitored in the species reported positive and in others that can potentially accumulate the toxins and can be used as human food [17]. We also detected the presence of the toxic amino acid β-N-methylamino-L-alanine (BMAA) in several strains of cyanobacteria isolated from estuaries in the north of Portugal [18-20]. We developed and optimized two analytical methods – HPLC and capillary electrophoresis to quantify (BMAA) in several matrices [18-20]. The data gathered so far allowed us to hypothesize that there might be some emergent marine biotoxins that need further survey in order to propose new guideline values in European waters. Recently, the EFSA has launched some documents regarding some of these emerging toxins, namely on PTX and CTX calling the attention for the need to get more detailed data both in the toxins occurrence and on their toxicology [21,22]. To get evidences that can be used in coastal risk analysis, there is a need for a more detailed survey of emergent marine toxins.

References


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