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## Study of the neurotoxic thermophilic dinoflagellate Vulcanodinium rugosum in French Mediterranean lagoons facing global change : morphogenetic and toxinic characterization, ecology and toxins transfer in trophic levels, risk to human health.

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Harmful phytoplankton blooms have growing impacts on ecosystems and human populations. In the context of warming waters and oceans, they are one of the main issues linking environmental, animal and human health. We studied the toxic microalga Vulcanodinium rugosum, which produces pinnatoxins (PnTX) and portimines (Prtn). These toxins accumulate in marine organisms and are frequently detected worldwide. We characterized morphologically, genetically and on toxins level this dinoflagellate and studied its ecophysiology. Our results demonstrated its thermophilic and euryhaline features and its growth ranges between 20 and 30°C. Its ability to grow on an organic nitrogen source was showed. Its expansion in French Mediterranean lagoons was confirmed by the contamination of the mussels. The survival of this organism in the digestive tract of mollusks proves that the transfer of shellfish is potentially a source of contamination of new ecosystems. We also determined the distribution in relationship with environmental conditions in four French Mediterranean lagoons, the contamination by PnTX G and Prtn A of various marine organisms, the ecological impacts and the health risks. We showed that Vulcanodinium and toxins could contaminate a wide variety of marine species including bivalve mollusks, fish, gastropods and echinoderms. The kinetics of contamination and elimination in oysters showed that PnTX G persisted for a long time in bivalve mollusks' tissues. The information and tools we developed should be of great interest to environmental and health monitoring managers. This study also led to questions concerning the general expansion of V. rugosum area, other species that could possibly be contaminated, sub-lethal impacts on marine organisms, and the chronic risks to humans inherent in persistent contamination in seafood products. Studies focusing on this dinoflagellate and its toxins are important, particularly in the context of warming waters favoring blooms on a global scale.