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Vulcanodinium rugosum - a potent and ubiquitous genus affecting mice and man

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The monotypic genus *Vulcanodinium* was erected in 2011 [1], and the unique species *V. rugosum* was associated with the production of pinnatoxins the same year [2]. According to its morphology, *V. rugosum* is closely related to peridinioid/scrippsielloid dinoflagellates, such as the genus *Bysmatrum* from which it can be distinguished mainly by the pattern of anterior intercalary plates. Based on LSU rDNA sequence data, the taxon was shown to belong to the order Peridiniales but it was not possible to affiliate it to a particular family, and molecular data showing a rather high divergence from other peridinioids supports the erection of the genus. Few studies focused on the life cycle of this organism [3, 4], but while *V. rugosum* has been observed as a pelagic species, it also frequently forms clusters of non-motile (temporary cyst-like) cells embedded in a highly adherent mucous. Its pelagic life forms obviously may contribute to its spread and some of the effects discussed below.
Pinnatoxins (PnTXs), and their derivatives, pteriatoxins (PtTXs), are a group of macrocycles with cyclic imine and spiro-functions similar to spirolides and have been identified in shellfish well before the discovery of their causative organism [5-9]. Pinnatoxins are potent neurotoxins that were discovered using an isolation scheme bioguided by intraperitoneal mouse bioassay [7]. The toxins act via blocking neurotransmission through their strong binding to the nicotinic acetylcholine receptor [10, 11], and also activate Ca^{2+}-channels and inhibit expression of vascular cell adhesion molecule 1 (VCAM-1) [12]. After isolation of a peridinioid dinoflagellate producer in New Zealand and the isolation of pinnatoxins E and F in 2010 [13, 14], pinnatoxins were also rapidly reported in Australia, China, Japan, Canada and Europe in both algal strains and shellfish in areas of different ecology, notably Norway and France [2, 4, 15-20], even if numerous ecological studies suggest warm water temperatures as a driver for significant bloom development [21-24]. There is significant diversity of PnTXs among strains isolated from different regions which may vouch for further studies on intra-specific genetic diversity, and ballast water or other ship vectors have been suggested as a possible route of distribution of these organisms around the globe.
Studies on the cytotoxicity of the first French strain suggested presence of several toxins [25, 26]. Indeed, a novel toxin, i.e. portimine, was simultaneously reported from a New Zealand strain. Portimine is a small macrocycle that also contains a cyclic imine group but only a single carbon with spiro-functionality, and presents greater cytotoxicity than PnTXs. Contrarily to the diversity of PnTXs, all strains characterized globally appear to produce portimine. Shellfish appear to preferentially accumulate PnTXs rather than portimine, and PnTXs have been classified as fast acting or presenting atypical toxicity observed in mice, i.e. symptoms within 15 min. Still, to date, no acute intoxication through consumption of shellfish by humans has been confirmed to have been caused by PnTXs. Surprisingly, a bloom of *V. rugosum* in Cienfuegos Bay, Cuba, has been reported to cause dermatitis in bathers [24], and we report here an event in Senegal where, in addition to PnTX-H, record values for portimine occurred in an offshore environment affecting artisanal fishermen with similar symptoms in 2020 and 2021. Further research is underway to elucidate causative compounds and mechanisms of toxicity as well the genetic signature of strains involved.

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