Environmental challenges and chromosomal Instability: a decade of Aneuploidy in the Arabian Gulf pearl oyster Pinctada radiata

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Abstract

The Arabian Gulf experiences seasonal exposure to extreme water temperatures, reaching up to 35-37∘C, along with significant salinity fluctuations characterized by an average increase of 43psu and occasional extreme values reaching 70psu. Nevertheless, despite the prevailing harsh environmental conditions, several ecologically significant ecosystems persist in the Gulf, such as coral reefs, mangroves, sea grasses and oyster beds. The pearl oyster *Pinctada radiata*, inhabiting the Qatari coast experiences temperature variation exceeding +20∘C degrees between summer and winter, along with elevated salinity levels that reach up to 59 ppt in some areas. From 2013 to 2023, genotoxicity assessment in the Qatari marine environment, through investigation of levels of aneuploidy -abnormal chromosomal number- using *P. radiata*, as model and surrogate species was performed. We observed an interesting pattern of chromosomal gain -hyperdiploidy- rather than loss of chromosomes -hypodiploidy- which is the common trait in the majority of bivalves studied so far worldwide. This is the first time that hyperdiploidy has been documented in marine bivalves with high prevalence. This pattern was further explored through differential banding with restriction enzymes, providing evidence of preferential gain/loss of specific chromosome pairs. This finding was consistently observed across all studied sites along the Qatari coast raising the question of whether this represents a species-specific aneuploidy pattern. To date, no studies have been published on aneuploidy in this species from other regions.The question being raised if this phenomenon is an adaptative response to environmental stress or indicates that this species is on the verge of evolutionary divergence.

Keywords: Aneuploidy, extreme environment, Arabian Gulf, Pearl oyster, hyperdiploidy

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