How does varying photoperiod affect the physiology and toxicity of the diatom Pseudo-nitzschia?

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Résumé

Pseudo-nitzschia species form pluriannual blooms over the French coasts during the light-evolving seasons of spring and autumn. Such blooms may contain domoic acid-producing Pseudo-nitzschia species or non-toxic ones, which represent a potential threat for seafood contamination and human disease. One major question is how the photoperiod variation may affect the physiology of toxic and non-toxic species of Pseudo-nitzschia. Therefore, we assessed in batch cultures, how decreasing or increasing the photoperiod may influence the photosynthetic activity, pigments, primary metabolites and toxin production in the toxic P. australis and the non-toxic P. delicatissima cells. We observed similar physiological responses to photoperiod change for the toxic and non-toxic species suggesting that toxicity is not influencing the remaining P. australis metabolism. Surprisingly, increasing photoperiod leads to an earlier population decline whilst reducing photoperiod leads to a new growth phase. For both species, the population decline is characterised by a decrease of photosynthetic activity (Fv/Fm, ETR), the loss of photosynthetic system integrity (Chl-a degradation into chlorophyllids and an increase of accessory pigments), the setting of photoprotective mechanisms (increase of xanthophyll content and the NPQ fraction) and for P. australis, an increase of toxin production. In contrast, reducing photoperiod leads to restarting cell division, maintaining the pool of Chl-a and for P. australis, limiting toxin production. Hence, Pseudo-nitzschia cells seem to adapt their metabolic activity by "shifting to a lower gear" supporting growth but not toxin production. Finally, domoic acid appeared to be produced continuously by P. australis, following an antagonist pattern to cell growth.

Mots-Clés: Pseudonitzschia, domoic acid, pigments, photosynthesis, photoperiod

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