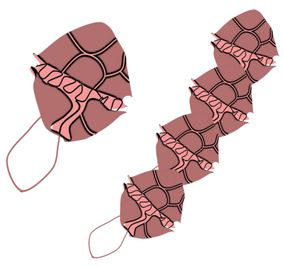
Unveiling saxitoxins (STXs) synthesis potential of dinoflagellate *Alexandrium* through STXs synthesis genes (*sxt*) analysis

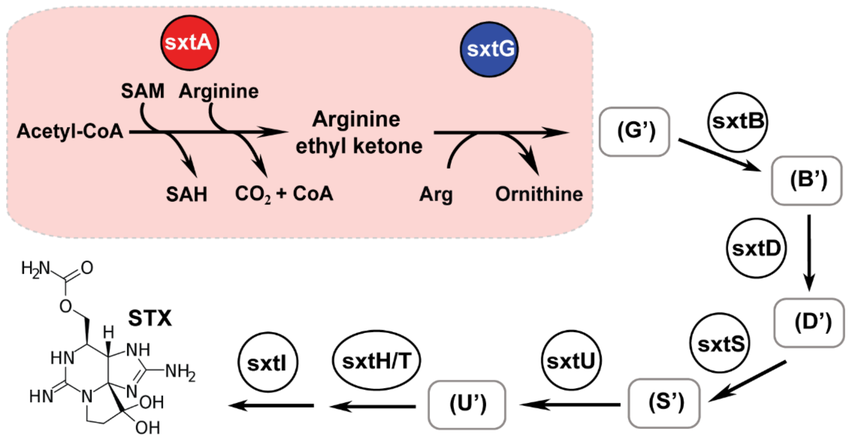
Han-Sol Kim [1], Quynh Thi Nhu Bui [1], Jeongmin Shin [1], Taehee Kim [1], and Jang-Seu Ki [1]*

[1]Department of Biotechnology, Sangmyung University, Seoul 03016, Republic of Korea

Background & Purpose



Saxitoxins (STXs)
producing dinoflagellates



- Marine dinoflagellate *Alexandrium* occurs in oceans around the world, and some can form harmful algal blooms and produce toxic substances, **saxitoxins (STXs)**.
- **STXs synthesis genes (*sxt*)** are known to be important for STXs production ability, however, it remains controversial.
- In the present study, we identified several *sxt* genes from toxic and nontoxic *Alexandrium* species through transcriptome analysis.
- Physiological and transcriptional responses of *A. affine* under various nutrient and temperature conditions were analyzed

Materials & Methods

Hiseq sequencing
(Illumina)

STXs analysis
(Waters, HPLC-FLD)

- *A. catenella, A. pacificum* and *A. affine* were obtained from Korea Institute of Ocean Science & Technology (KIOST, Jangmok, Korea).

Results

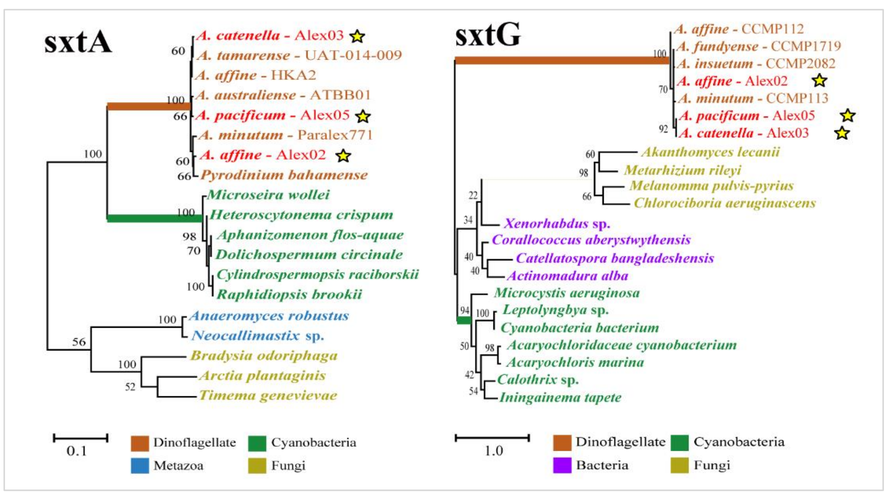


Figure 1. A maximum likelihood (ML) tree of core enzymes sxtA4 and sxtG identified from *Alexandrium* comparing with diverse organisms. Each enzymes are phylogenetically conserved among toxic dinoflagellates.

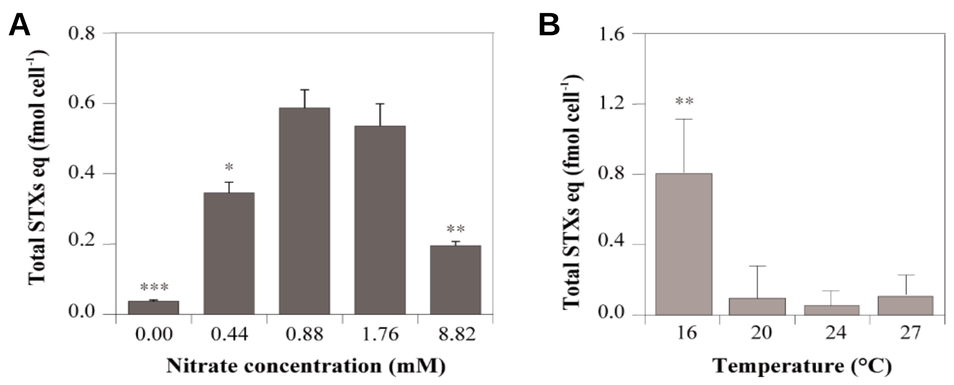


Figure 2. Total toxicity of *Alexandrium affine* cultured under various nitrate concentrations (A) and water temperatures (B). STXs level of *A. affine* is up to 100-fold lower than that of *A. pacificum* and *A. catenella*, and toxin levels are varied by environmental changes.

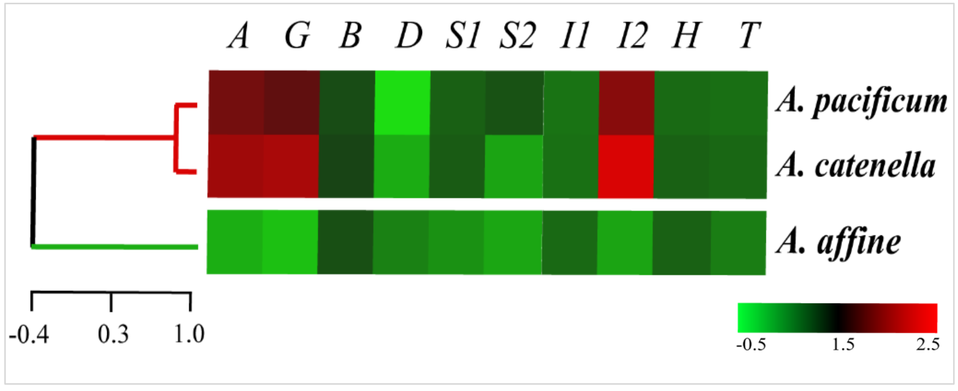
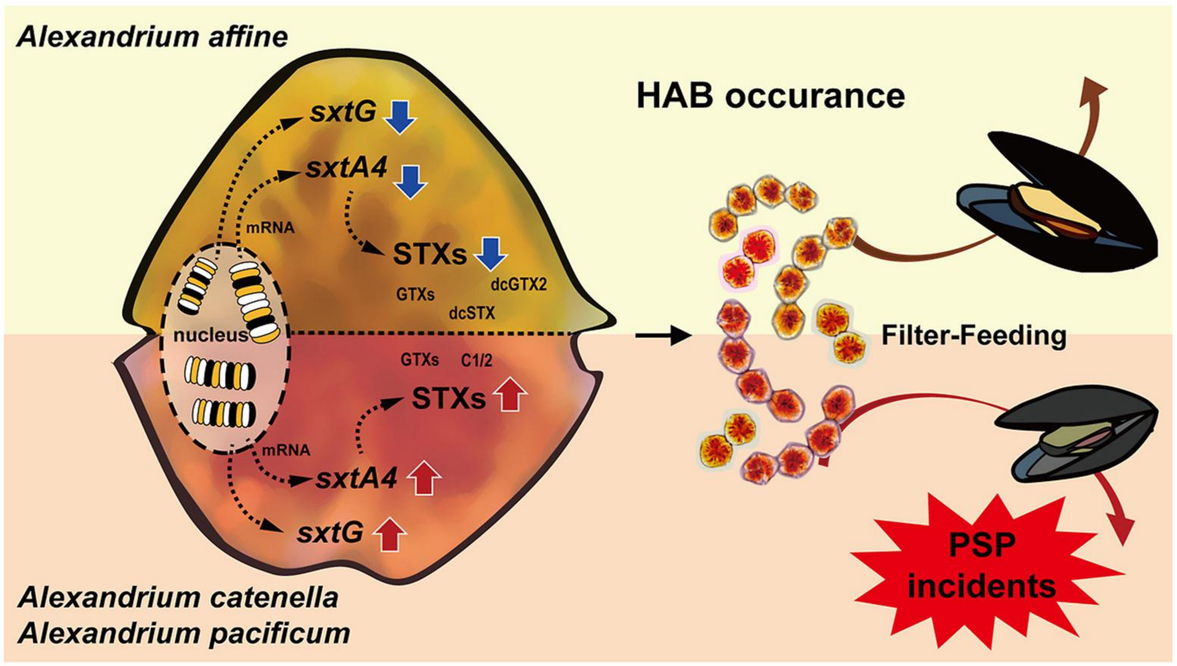


Figure 3. A heatmap of *sxt* RPKM (Reads Per Kilobase of transcript, per Million mapped reads). Expressional patterns of *sxt* were varied among toxic and non-toxic species, with significantly lower expression levels of *sxtA*, *sxtG*, and *sxtI* in *A. affine*.

Graphical Abstract & Conclusion



- A. affine is well known as a non-toxic species, with the exception of certain strains from Vietnam (Nguyen-Ngoc, 2004) and the Philippines.
- Similarly, STXs were detected in *A. affine* isolated from the southern coast of Korea, and its total STXs were significantly lower (<0.8 STXs eq fmol/cell) than those of toxic *A. catenella* and *A. pacificum*.
- STXs biosynthesis *sxt* genes were identified in *A. affine* through transcriptome analysis, transcript levels of the *sxtA*, *sxtG* and *sxtI* of *A. affine* were extremely low.
- These suggest that *A. affine* has the potential to produce STXs, however, the **toxicity is much lower or negligible, making it less likely to cause PSP incidents in marine environments**.

Acknowledgements