Bioluminescence induction in *Amphiura filiformis*

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Abstract

Bioluminescence is the capability to emit visible light thanks to a biochemical reaction. About 80% of the known luminous species live in the marine environment. Among luminous substrates, coelenterazine is the most widespread luciferin found in at least eight phyla. The broad phylogenetic distribution of this light-emitting molecule led to the hypothesis of its dietary acquisition, so far demonstrated in one cnidarian[1] and one lophogastrid shrimp[2] species. Within Ophiuroidea, the dominant class of luminous Echinoderms, *Amphiura filiformis* is a brittle star model species known to use coelenterazine as substrate in a luciferin/luciferase reaction.

A previous study performed long-term monitoring of *A. filiformis* luminescent capabilities maintained in captivity under controlled conditions[3]. Our results showed (*i*) depletion of luminescent capabilities within five months when the ophiuroid was fed with a coelenterazine-free diet and (*ii*) after 15 months in captivity, *A. filiformis* showed a quick recovery of luminescent capabilities when fed with coelenterazine supplemented food. The results strongly support for the first time the trophic acquisition of coelenterazine in one brittle star.

Current work on *A. filiformis* aims to go further on different aspects: (*i*) does seasonal variations of luminescence capabilities exist; (*ii*) what is the natural source of coelenterazine in the Swedish fjörd, (*iii*) how often the brittle star has to refill the stock of luminous substrate.

To date, *A. filiformis* luminous capabilities were measured in summer, fall, and winter to evaluate potential seasonal variations. In parallel, analysis of the fjord planktonic communities and biochemical assays confirm the presence of species containing coelenterazine within potential *A. filiformis* preys. Stomach content DNA-barcoding is currently in progress to identify brittle star diet. This strategy will allow making a match between the brittle star's prey and plankton species known to contain coelenterazine.

Moreover, long-term monitoring of the brittle star luminous capabilities is performed to evaluate (*i*) the depletion and reacquisition timing for each season, and (*ii*) the frequency of the coelenterazine input in the *A. filiformis* diet to conserve its bioluminescence capabilities.

Keywords: Bioluminescence; Brittle star; Trophic acquisition; Coelenterazine

References

[1] S. H. D. Haddock, T. J. Rivers, B. H. Robison, Proceedings of the National Academy of Sciences 98 (2001) 11151.

[2] T. M. Frank, E. A. Widder, M. I. Latz, J. F. Case, Journal of Experimental Biology 109 (1984) 385-389.

[3] J. Mallefet, L. Duchatelet, C. Coubris, Journal of Experimental Biology 223(4) (2020) jeb218719.

Acknowledgements

This work was supported by Assemble+ funding (EU afilum 261) and a travel grant (n° 40009595 and n° 40010151) of the Fonds de la Recherche Scientifique (FRS-FNRS, Belgium).