

## Saponins vs Anthraquinones: Different Chemicals, Similar Ecological Roles in Marine Symbioses

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**Abstract :** Saponins and quinones are two major groups of secondary metabolites widely distributed in the biosphere. More specifically, triterpenoid saponins and anthraquinones are mainly found in a wide variety of plants, bacteria and fungi. In the animal kingdom, these natural organic compounds are rare and only found in small quantities in arthropods, marine sponges and echinoderms. In this last group, triterpenoid saponins are specific to holothuroids (sea cucumbers) while anthraquinones are the chemical signature of crinoids (feather stars). Depending on the species, they present different molecular cocktails. Despite presenting different chemical properties, these molecules share numerous similarities. This study compares the biological distribution, the pharmacological effects and the ecological roles of holothuroid saponins and crinoid anthraquinones. Both of them have been defined as allomones repelling predators and parasites (i.e. chemical defense) and have interesting pharmacological properties (e.g. anti-bacterial, anti-fungal, anti-cancer). Our study investigates the chemical ecology of two symbiotic associations models; between the snapping shrimp *Synalpheus stimpsonii* associated with crinoids and the Harlequin crab *Lissocarcinus orbicularis* associated with holothuroids. Using behavioral experiments in olfactometers, chemical extractions and mass spectrometry analyses, we discovered that saponins and anthraquinones present a second ecological role: the attraction of obligatory symbionts towards their hosts. They can, therefore, be defined as kairomones. This highlights a new paradigm in marine chemical ecology: Chemical repellents are attractants to obligatory symbionts because they constitute host specific chemical signatures.

**Keywords :** anthraquinones, kairomones, marine symbiosis, saponins, attractant

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