

Saponins: multitasking chemical signatures in asteroids and holothuroids

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Organisms live in a world of odors and flavors where each living or inert entity releases distinct molecules in the environment. Marine organisms, in particular, rely on environmental chemical cues during their entire life, from early developmental to adult stages. Particularly, the phylum Echinodermata presents specific chemicals for each class. Saponins are triterpenic or steroidal glycosides that are produced by all investigated species of holothuroids and asteroids. Due to their amphiphilic properties, these molecules can interact with sterols in biological membranes, rendering saponins noxious and repellent to most organisms (e.g., ichthyotoxic effect). Despite this role of chemical defense, sea cucumbers and seastars harbor diverse symbiotic communities composed of crustaceans, polychaetes and even carapid fishes that developed biological adaptations to resist to saponins. Not only symbionts may benefit from the chemical defense of their hosts to reduce their predation rate, they can also use saponins as kairomones to specifically recognize their host by chemical communication. Recently, we even discovered that holothuroids use saponins as an aggregation pheromone, having a particularly important role in their reproduction.

This study highlights the diverse functions of saponins in seastars and sea cucumbers, ranging from repellent allomones to attractive pheromones and kairomones. These essential metabolites have been strongly selected throughout evolution, with each species possessing its unique chemical signature allowing it to interact with the environment.

Keywords

Chemical Ecology; Saponins; Echinoderms