

Resistance to Toxicity in the soft coral *Lobophytum compactum*

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The Great Barrier Reef (GBR) serves as home to over 150 coral species and is the site of the annual mass spawning of these corals. During this mass spawning corals release gametes into the water column for fertilization. In order for fertilization to ensue, the gametes must interact. Changes in water quality due to pollutants can be potentially harmful to the fertilization process and can ultimately affect its success. Successful fertilization of gametes is crucial to sustain coral reef populations. Reichelt-Brushett and Michalek-Wagner (2005) recognized that understanding the effects of pollutants on fertilization success is significant in conservation management of coral reefs.

Reichelt-Brushett and Michalek-Wagner (2005) used data from a previous study to choose which pollutant they would use in their experiment. Previous research regarding the effects of toxins on gamete fertilization in corals found copper to have the most harmful effect. Copper was also a good candidate for this experiment because it is often found in higher concentrations around ports and harbours in the GBR as it is an ingredient in the paint often used on boats. When ships run aground, coral reefs not only suffer physical destruction, but also contamination from toxins like copper.

Lobophytum compactum, the soft coral chosen for the experiment, is a reef-flat coral, commonly found on the inner shelf of the GBR. In October of 2004, twenty colonies of *L. compactum*, both male and female, were randomly selected for collection 10 days before the mass coral spawning. They were collected from the intertidal zone of Bay Rock, an island in Cleveland Bay. They were moved immediately to a 2.5 million-L coral reef mesocosm at the research lab.

While egg nets were used for egg collection, sperm collection was a bit more difficult. Several hours prior to spawning, 5 male colonies of *L. compactum* were removed and put into a 400-L aquarium. After spawning, the sperm water was diluted to a concentration optimal for the experiment (10^4 sperm/mL). Several 5 mL samples of this sperm water were put in 20 mL glass vials. Other vials each contained 100 eggs, diluted with 5 mL of sperm-free salt water (SFSW). Solutions of various copper concentrations were made by diluting a CuCl_2 stock solution with SFSW. Five mL amounts of the copper solutions were added to each of the glass vials containing eggs and sperm separately. No copper solution was added to the control group; instead 5 mL of SFSW was added. After 30 minutes, vials containing sperm water solutions were added to those containing egg water solutions and were placed in mesh bags in an aquarium to simulate normal fertilization conditions. Divided embryos and undivided eggs were counted to determine fertilization success. In order to analyze copper levels in gametes, eggs collected after spawning were transported to Southern Cross University for assessment. A spectrophotometer was used to determine copper levels.

Because the initial experiment yielded few effects on fertilization success, the experiment was repeated using more concentrated copper solutions. Reichelt-Brushett and Michalek-Wagner (2005) found experiment 1 to yield 90% fertilization among the control group and 68% at copper concentrations up to $132 \mu\text{g/L}$. The EC_{50} , the concentration that reduces the fertilization rate by 50% relative to the control fertilization, could not be determined for experiment 1 because fertilization success never fell below 50%. Experiment 2, on the other hand, had an EC_{50} of $261 \mu\text{g/L}$. This value is significantly high when compared to the results of other coral fertilization toxicity tests. .

Previous research shows most corals to have an EC₅₀ value in the range of 15-39 µg/L. These results suggest that *L. compactum* gametes have a higher resistance to copper than most other corals. In fact, it seems they have a higher resistance to most marine taxa. Most other marine organisms have an EC₅₀ value for copper effects on fertilization that falls into the range of 7-55 µg/L (Reichelt-Brushett and Michalek-Wagner, 2005).

Reichelt-Brushett and Michalek-Wagner (2005) suggest that one explanation for the observed higher resistance to copper may be a result of the coral's gametogenic cycle. *L. compactum*, a soft coral, has a 24 month cycle, while all hard corals have a 4-9 month cycle. This means that the eggs of *L. compactum* can be exposed to copper in the water for more than twice the amount of time of hard corals. Ironically, the *L. compactum* eggs used in the experiment were found to have a lower concentration of copper than those of the hard coral *Acropora tenuis*, which inhabits the same area. *L. compactum* had a mean concentration of 4±1 µg/g, while *A. tenuis*' was 28±1µg/g (Reichelt-Brushett and Michalek-Wagner, 2005). Apparently, extended exposure to traces of copper does not result in higher concentration of the metal in this soft coral. Reichelt-Brushett and Michalek-Wagner (2005) suggest that perhaps *L. compactum* has developed a biochemical detoxification mechanism as a result of copper exposure. While Reichelt-Brushett and Michalek-Wagner's experiment demonstrated copper effects on gamete fertilization, research on its effects during other stages of life might further explain this soft coral's high resistance to copper.

Literature Cited

A.J. Reichelt-Brushett and K. Michalek-Wagner (2005). Effects of copper on the fertilization success of the soft coral *Lobophytum compactum*. *Aquatic Toxicology* 74: 280-284.