Mechanisms of Coral Aggression and How to Control It

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When looking at pictures of a reef, the first thing noticed is the diversity of life. All space on the reef is filled with different organisms suited to fill every niche. This diversity is the result of the organisms evolving through competition. One factor underlying this competition is aggression, both subtle and overt. Aggression occurs in corals as a result of their constant battle for survival. Corals have to cope with currents, predation by fish and other invertebrates, as well as competition from neighboring corals for light, nutrients, and food.

Mechanisms of aggression

Corals have developed several specialized mechanisms for protection and competition with other corals. These include sweeper tentacles, mesenterial filaments, and terpenoid compounds (Ates, 1989). The picture at the right depicts incompatabilities between several coral species. Incompatabilities may be indicated by a color change, such as the white discoloration of part of the finger leather coral on the left. In reaction to nearby corals, the large tan mushroom coral in the middle has concentrated its poison in the white ends of its tentacles.

Sweeper tentacles

Sweeper tentacles are the most common defense mechanisms in the hard corals. These mouthless elongated tentacles form the outermost portion of the coral colony and act as a "patrol" along the periphery. When a sweeper tentacle encounters a competing coral, it may attack the competing coral and literally "burn" the offending coral to the point of either killing it or severely damaging it. This "burning" is the result of specialized stinging cells called 'nematocysts' that are present in these tentacles (Talbott, 1984). The chemical present in these nematocysts is an alkali toxin similar to bee venom. This may be why corals are said to "sting one another." The relative toxicity of these tentacles differs among various species of corals, as does the length to which these tentacles can elongate (Sheppard, 1982). This degree of toxicity is important because:

- If two corals fall into each other, the relative toxicity of their nematocysts will determine how long they can be in contact before serious injury results. It is possible for corals to be killed after falling into another coral after just fifteen minutes of contact.
- When two corals have relatively equal toxicity in their nematocysts, it is possible for them to kill each other when they fall together. This is why it is important to take precautions to prevent corals from falling into one another.

The length of sweeper tentacles is not correlated to the length of the normal coral polyp and may, in fact, be many times longer. One of the most dramatic illustrations of this is in the sweeper tentacles present on *Pavona cactus*, a SPS (small polyp stony) coral that has branches which are only millimeters thick, and resemble potato chips. Despite the fact that the branches of this coral are only several millimeters thick, the sweeper tentacles that come out may be four or five centimeters long. Another example of dramatic elongation of sweeper tentacles is seen in the Crystal coral (*Galaxea fascicularis*). In this coral, normal polyps are only one to two centimeters long, while sweeper tentacles have been seen that are 30 cm long and contain a very potent nematocyst. Therefore, when selecting this coral, care should be taken to provide abnormally wide spacing between it and other corals.

Sweeper tentacles may appear when one coral is placed in close proximity to another or it senses the presence of another aggressive coral. I have observed this phenomenon first hand with my Crystal coral. When first placed in my tank, no sweeper tentacles appeared during the first three months. However, when I placed a Hammer coral (*Euphyllia sp.*) in this same tank, the sweeper tentacles appeared within three days. These tentacles also appear to be able to sense where the competitor is located in that, regardless of where I placed the Crystal coral relative to the Hammer coral, the sweeper tentacles always developed toward the Hammer coral. Interestingly, the Hammer coral also developed sweeper tentacles, but they were present all over the outer perimeter of the colony.

Until recently, I had never read or heard about soft corals producing these tentacles. However, in the 1,000-gallon aquarium of my friend, Dr. Michael Fontana, I observed a Leather coral (*Sarcophyton sp.*) producing very fine sweeper tentacles that were irritating a nearby zoanthid colony. These tentacles did not appear to be as well defined as the sweeper tentacles produced by the stony corals, but they appeared to produce the same result.

Mesenterial filaments

In addition to sweeper tentacles, several hard coral species can produce mesenterial filaments (also termed mesenteric filaments) from their stomachs. Corals of the genera *Favia*, *Favites*, *Scolymia*, *Pavona*, and *Cynarina* all have this capacity (Chadwich, 1987). These filaments can kill or devour other coral polyps through a process similar to digestion. Some corals even have the capacity to produce both sweeper tentacles and mesenterial filaments, enabling them to fight a battle on several fronts (Wallace, 1984).

Terpenoid compounds

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The soft corals generally compete with the hard corals by releasing 'terpenoid' or 'sarcophine' compounds into the water to injure or impede the growth of neighboring corals, and then overgrow these impeded individuals in a process called "allelopathy" (Delbeek and Sprung, 1994). Like their name implies, these compounds are similar to turpentine in chemical structure and in most instances, are just as toxic. By releasing these compounds, the soft coral injures these neighboring stony corals and can thus grow above them, eventually blocking out the light that they are both dependent upon and thereby killing the underlying hard coral.

Controlling aggression

While a miniature reef does not contain the great diversity of life that an actual reef does, provisions should still be made to try and minimize the aggression among corals. This can be accomplished by providing adequate spacing, reducing tip over potential, and taking action if aggression does occur.

Provide adequate space

As noted previously, the relative aggressiveness among coral species varies. Consequently, when setting up a tank, adequate space, which is invertebrate free, should be given around each coral head.

Hard Corals: For LPS (large polyp stony) corals, this zone should be at least 15 cm in all directions, as sweeper tentacles have been reported to be at least this long (Sheppard, 1982). The distance between SPS corals does not need to be as great; a distance of 5-8 cm is usually sufficient. However, it should be noted that these are the fastest growing of all corals, so extra space should be allowed for this. For this reason, I suggest that a buffer zone of 30% of the coral colony's size be used when originally placing the corals in order to allow for growth. This may seem extreme and may initially make the tank look sparsely decorated. However, in a well-designed and maintained reef tank, this space will be almost completely filled within the first year simply from growth. If growth space is not provided, there will be a constant need to prune corals lest they burn and kill one another.

Soft Corals: For the most part, the space between soft corals does not need to be as great initially, since soft corals do not burn each other to the same degree as the hard corals do. Consideration in placing soft corals needs to take into account:

- A faster growing coral will overshadow a slower growing coral and eventually starve it out for light.
- These corals should be positioned so that their mucous and terpenoids do not come into direct contact with their neighbors. That is, these corals will do the least harm to other corals if the water movement in the tank is such that after the water moves across them it flows down an overflow and into a sump where the harmful compounds can be removed with either skimming or carbon filters.

Minimize tip over potential

Tip over potential is the likelihood that one coral will tip over and land on another coral, and as a result, burn or be burned by the other coral. This may seem trivial, but I have lost whole colonies of coral due to a small part of the colony being burnt as a result of it falling into another colony. The burned area became infected and consequently, the whole colony died. Tip over is particularly troublesome for SPS corals, which usually arrive unattached to anything. Therefore, when placing these corals on my live rock structure, I often use a dab of waterproof epoxy to hold them in place until they encrust over the area themselves. An alternative is to use rubber bands or plastic cable ties to anchor the colonies in a less permanent manner. If colonies do fall into one another they should be separated as quickly as possible, and any damage washed off in the current to try and rid the animal of nematocysts.

Reduce harmful effects of aggression

In a miniature reef aquarium, aggressiveness can have severe and dire consequences in that, if allowed to progress to its conclusion, a large and expensive coral head could die. If these sweeper tentacles or mesenteric filaments are observed, the reef keeper should make sure to move all invertebrates in their proximity out of the way. However, if these tentacles have reached their target, they should immediately be removed, allowing no touching with other organisms. If a portion of tentacle remains attached to another invertebrate, it should be physically removed immediately. If not, the toxin that the tentacle secretes will continue to work and will kill the colony to which it has become attached. Fortunately, if the reef tank is well maintained and no microalgae are allowed to grow on the skeleton, the coral colony may recover and grow back over the damaged area.

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