Marine plants can flee to avoid predators, researchers say

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Scientists at the University of Rhode Island's Graduate School of Oceanography have made the first observation of a predator avoidance behavior by a species of phytoplankton, a microscopic marine plant. Susanne Menden-Deuer, associate professor of oceanography, and doctoral student Elizabeth Harvey made the unexpected observation while studying the interactions between phytoplankton and zooplankton.

Their discovery will be published in the September 28 issue of the journal PLOS ONE.

"It has been well observed that phytoplankton can control their movements in the water and move toward light and nutrients," Menden-Deuer said. "What hasn't been known is that they respond to predators by swimming away from them. We don't know of any other plants that do this."

While imaging 3-dimensional predator-prey interactions, the researchers noted that the phytoplankton Heterosigma akashiwo swam differently in the presence of predators, and groups of them shifted their distribution away from the predators.

In a series of laboratory experiments, Menden-Deuer and Harvey found that the phytoplankton not only flee when in the presence of the predatory zooplankton, but they also flee when in water that had previously contained the predators. They found only a minimal effect when the phytoplankton were exposed to predators that do not feed on

phytoplankton.

"The phytoplankton can clearly sense the predator is there. They flee even from the chemical scent of the predator but are most agitated when sensing a feeding predator," said Menden-Deuer.

When the scientists provided the phytoplankton with a refuge to avoid the predator – an area of low salinity water that the predators cannot tolerate – the phytoplankton moved to the refuge.

The important question these observations raise, according to Menden-Deuer, is how these interactions affect the survival of the prey species.

Measuring survival in the same experiments, the researchers found that fleeing helps the alga survive. Given a chance, the predators will eat all of the phytoplankton in one day if the algae have no safe place in which to escape, but they double every 48 hours if they have a refuge available to flee from predators. Fleeing makes the difference between life and death for this species, said Menden-Deuer.

"One of the puzzling things about some phytoplankton blooms is that they suddenly appear," she said. "Growth and nutrient availability don't always explain the formation of blooms. Our observation of algal fleeing from predators is another mechanism for how blooms could form. Amazingly, looking at individual microscopic behaviors can help to explain a macroscopic phenomenon."

The researchers say there is no way of knowing how common this behavior is or how many other species of phytoplankton also flee from predators, since this is the first observation of such a behavior.

"If it is common among phytoplankton, then it would be a very important process," Menden-Deuer said. "I wouldn't be surprised if other

species had that capacity. It would be very beneficial to them."

In future studies, she hopes to observe these behaviors in the ocean and couple it with genetic investigations.

More information: dx.plos.org/10.1371/journal.pone.0046438

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