Learning to better understand the language of algae

November 1 2022

A view through the microscope onto the diverse microalgal community of a freshwater lake, including diatoms, green algae and dinoflagellates/chryosphytes. Credit: Dr. M. Stockenreiter / LMU Munich

Can algae talk? "Well, although they don't have any mouth or ears, algae still communicate with their own kind and with other organisms in their surroundings. They do this with volatile organic substances they release into the water," says Dr. Patrick Fink, a water ecologist at the UFZ's Magdeburg site.

These chemical signals are known as BVOCs (biogenic volatile organic compounds) and are the equivalent of odors in the air with which flowering plants communicate and attract their pollinators. When under attack by parasites, some plant species release odors that attract the parasites' natural enemies to them.

"Algae also employ such interactions and protective mechanisms," says Fink. "After all, they are among the oldest organisms on Earth, and chemical communication is the most original form of exchanging information in evolutionary history. However, our knowledge in this area still remains very fragmentary."

Patrick Fink is the corresponding author of the article recently appearing in *Biological Reviews*, where he has summarized the current status of research in the chemical communication of algae.

"For example, we know from laboratory investigations that some species of cyanobacteria keep water fleas at bay by releasing BVOCs in the water. This signal apparently acts as a repellent and has a true added value for the algae, namely that of effective grazing protection," says Fink.

In contrast, it is not yet understood why some freshwater algae growing as biofilms on rocks or shellfish shells, for example, release BVOCS on grazing by pond snails. Because: These chemical signals attract more snails. "The pond snails very clearly use the BVOCs to their advantage—but it remains unknown what function they actually serve for the algae," says Fink.

An example from the ocean: A diatom bloom represents a true feast for copepods. This rich offering of nutrients should ensure that their population subsequently grows. However, this is not the case.

"Although the copepods are well nourished, their spawn that they carry with them in their egg sack is at serious risk. Because the BVOCS from the diatoms impede cell division and thus disrupt embryonic development," Fink explains "In this way, the diatoms prevent excessive predation on their descendants—thereby ensuring the preservation of their kind."

The language of algae was first detected in investigations of macroalgae in the early 1970s.

"Macroalgae—such as the bladder wrack also known from the coasts of Germany—reproduce by releasing gametes into the water. The male and female gametes each release pheromones so that they can also find each other in the vastness of the ocean," explains Dr. Mahasweta Saha, marine chemical ecologist at the Plymouth Marine Laboratory (PML) in Great Britain. "This was the first indication that algae communicate via chemical signals, and that they fulfill important ecological functions."

In their publication, the author duo references the presumably significant effect of BVOCS within aquatic ecosystems, identifies gaps in knowledge and indicates possible future research areas such as coevolutionary processes between signal senders and receivers or the consequences of changes in the environment caused by humans on aquatic ecosystems.

"As the primary producers, algae form the basis of life of all aquatic food webs," says Fink. "It is therefore important that we learn to better understand the chemical communication of algae and their basic functional relationships in aquatic ecosystems."

The authors believe that increased understanding of the language of algae could also have useful technical applications, such as in using chemical signals to deter parasites, thereby reducing the use of pharmaceuticals in aquaculture. A better understanding of the chemical communication paths is also important to enable the development of more efficient environmental strategies.

"We can't protect waters unless we understand the functioning of their internal regulation mechanisms," says Fink. Initial studies show that the chemical communication process of marine algae is disrupted by the increasing ocean acidification due to climate change.

"It is also highly likely that there will be interactions between micropollutants of human origin and the algal BVOCs. This disrupts the finely balanced chemical communication processes that have remained stable over extended periods—which can have serious consequences for the function of the aquatic ecosystems," Fink warns.

More information: Mahasweta Saha et al, Algal volatiles—the overlooked chemical language of aquatic primary producers, *Biological Reviews* (2022). DOI: 10.1111/brv.12887

Provided by Helmholtz Association of German Research Centres

Citation: Learning to better understand the language of algae (2022, November 1) retrieved 25 June 2024 from https://phys.org/news/2022-11-language-algae.html