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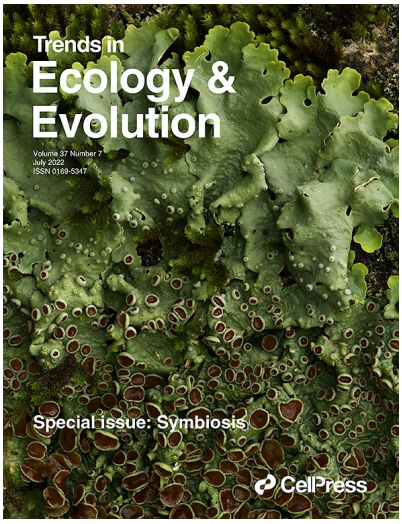
NYBG Scientist and Colleague Call for a New Approach to Studying Lichens to Learn Why They Are So Adaptable and Potentially Gain Valuable Insights into Nature Itself

In an Article in *Trends in Ecology & Evolution*, They Say Recent Research Challenges Traditional Assumptions about Lichens, Which Play Important Roles in Many Ecosystems



Bronx, NY— A New York Botanical Garden (NYBG) lichenologist and his colleague are calling for science to overturn traditional assumptions about the biology, ecology, and evolution of lichens, the remarkable organisms that are formed when a fungus and one or more other species combine in a mutually beneficial relationship. An updated perspective on lichens not only holds the potential to deepen science's understanding of this large and important group of species but also could yield valuable insights into the relationships that drive ecosystems, they write in the July 2022 issue of *Trends in Ecology & Evolution*.

In their article, "A call to reconceptualize lichen symbioses," NYBG Associate Curator James Lendemer, Ph.D., and Jessica Allen, Ph.D., an Assistant Professor of biology at Eastern Washington University, argue that rapid advances in generating and analyzing DNA data have led to an increasing recognition that the relationships in lichen species between fungi and other organisms are "far more complex, diverse, and flexible than has long been assumed."

Lichens grow on rocks, tree bark, and soil across the planet. Depending on the species, they can appear crusty and paint-like, relatively flat and round, leafy, or even shrub-like. Important but often overlooked members of the natural world, lichens are critical in many ecological

processes, provide food and habitats for animals and insects, and, because they are sensitive to pollution, are considered an indicator of an ecosystem's health. There are more than 20,000 known species, with more being discovered every year.

Drs. Lendemer and Allen note that the classical conception of lichens is that they are formed by highly specific combinations of a fungus and either an alga or an alga-like organism called a cyanobacteria. The fungus provides its partner with shelter, and the alga or cyanobacteria provides the fungus with nutrients produced by photosynthesis.

Recent DNA studies have shown, however, that fungi and algae are far more flexible in forming mutually beneficial relationships with a wide variety of symbionts, or partner organisms, and it is this flexibility and diversity that has made lichens so successful in adapting to challenging conditions such as nutrient-poor habitats and extremes of heat and cold.

Lichenologists have also gained greater understanding of the many other organisms that live on and within lichens, including other fungi and microalgae, bacteria, and micro-invertebrates such as nematodes and tardigrades. Together, they constitute a miniature ecosystem, according to the authors.

Drs. Lendemer and Allen propose a framework for studying lichen biology, ecology, and evolution that would investigate such questions as how and why lichens evolved, how new species are formed, the various functions played by the microbes that live within lichens, and the unique and complex ways in which lichens reproduce.

"Current advances in understanding the implications and outcomes stemming from symbiont diversity and flexibility demand a novel perspective on the patterns and processes within lichens, the communities they form, and the ecosystems within which they function," Drs. Lendemer and Allen write.

Unlocking the potential of lichens could place these dynamic organisms "at the vanguard of science," according to the authors, serving as model organisms that would help scientists and conservationists understand the interactions between species in general. Those interactions drive and structure the world's ecosystems, so gaining a deeper knowledge of them is vital to conserving biodiversity.

"A call to reconceptualize lichen symbioses" is part of a special issue of *Trends in Ecology & Evolution* devoted to symbiosis. A PDF of the article is available upon request to pubrel@nybg.org

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The New York Botanical Garden is a museum of plants, an educational institution, and a scientific research organization. Founded in 1891, the Botanical Garden is one of the world's preeminent centers for studying plants at all levels, from the whole organism down to its DNA. Garden scientists conduct fundamental research on plants and fungi globally, as well as on the many relationships between plants and people. A National Historic Landmark, the Garden's 250-acre site is one of the greatest botanical gardens in the world and the largest in any city in the United States, distinguished by the beauty of its diverse landscape and extensive collections and gardens, as well as by the scope and excellence of its programs in horticulture, education, and plant research and conservation. Learn more: nybg.org

The New York Botanical Garden, 2900 Southern Boulevard, Bronx, New York 10458

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