Researchers discover the secret of how moss spreads

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University of Copenhagen researchers have discovered how mosses became one of our planet's most widely distributed plants—global wind systems transport them along Earth's latitudes, to rooftops, sidewalks and

lawns worldwide, and as far away as Antarctica. This new knowledge can provide us with a better understanding of how other small organisms are spread, including airborne bacteria and organisms that produce airborne spores.

In a recent study, researchers from the Natural History Museum of Denmark at the University of Copenhagen have studied how one of the world's most widespread moss species, *Ceratodon pupureus*, AKA fire moss, purple horn toothed moss, etc., has managed to inhabit every crevice and corner of the planet.

"We found a remarkable overlap between global wind patterns and the way in which this moss species has spread over time, one that we haven't been aware of until now," says evolutionary biologist Elisabeth Biersma of the Natural History Museum of Denmark, who is the study's lead author.

According to Biersma, this means that much of the moss Danes find commingling with their lawn grass or lightly clinging to their rooftops is often part of the same population found on another continent at a similar latitude. For example, moss spores from North America are likely blown by the prevailing Westerlies across the Atlantic to Denmark.

One of the oldest plant groups on Earth

Mosses (*Bryophyta*) are one of the oldest plant groups on Earth and characterized by not having roots. Most groups grow in damp, shaded places, while others toleratebright and dry environments.

"Mosses are extremely resilient organisms that can both suck up a lot of water and tolerate considerable desiccation. Most other plants are far from being as resistant to harsh environments such as rooftops, sidewalks or polar climates. Along with the wind, this has been the key

to the great success of mosses the world over," explains Elisabeth Biersma.

There are roughly 600 moss species in Denmark, out of roughly 12,000 species found worldwide. In the study, researchers used moss samples sourced from dried plant collections called herbaria, from around the world. Using genetic samples of the mosses, the researchers built an extensive evolutionary tree that helped them map the various moss populations.

A better understanding of how airborne organisms spread

The researchers' analyses demonstrate that the current distribution pattern of C. purpureus has occurred over the last ~11 million years. But the fact that it has taken so long for C. purpureus to spread to the places where it is found today comes as a bit of a surprise

"This can probably be explained by the fact that global wind systems can partly disperse spores over a long distance, but also restrict global dispersion as wind systems are self-enclosed and isolated transport systems, which thereby restrict any spreading beyond them," explains Elisabeth Biersma.

This is the first time that the researcher has seen such a uniform pattern of proliferation across the globe, as demonstrated with *C. pupureus*. The knowledge may be transferable elsewhere.

"These findings could help us understand the spread of other organisms, such as bacteria, fungi and some plants, which are also spread via microscopic airborne particles transported by the wind. But only the future can say whether this knowledge is applicable to other organisms."

concludes Biersma.

The research was published in the scientific journal *Frontiers in Plant Science* and conducted in a collaboration among several universities and researchers.

More information: Elisabeth M. Biersma et al, Latitudinal Biogeographic Structuring in the Globally Distributed Moss Ceratodon purpureus, *Frontiers in Plant Science* (2020). DOI: 10.3389/fpls.2020.502359

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