

Scientists discover genes involved in a compound in lichens with antiviral activity

December 11 2020



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An international study led by researchers from the Faculty of Pharmacy at the Complutense University of Madrid has identified a series of biosynthetic genes involved in the production of usnic acid in lichen, a compound showing antiviral, antioxidant, neuroprotective, antibacterial and anticancer activity.

Not all lichens—composite organisms resulting from the symbiosis of fungi and [green algae](#) or cyanobacteria—produce this compound, and this study, published in *Genome Biology and Evolution*, has revealed why there is a loss of specific biosynthetic genes in non-producing species.

"Identifying the genes involved in the biosynthesis of these compounds is essential for future studies that require their isolation and [mass production](#); similarly, the genomic approach adopted in this study has helped us identify new biosynthetic genes (PKS) of as yet unknown compounds that may be of pharmacological interest," explained David Pizarro, the first author of the study and a researcher in the Department of Pharmacology, Pharmacognosy and Botany at the UCM.

To carry out this study, researchers sequenced the genomes of 40 lichen species that produce and do not produce usnic acid.

"The genomes were assembled, annotated and compared using bioinformatics tools and [computational biology](#), and we also analyzed the diversity of lichen compounds using chromatography," Pizarro added.

New family with unknown function

This study also identified and described a new family of biosynthetic genes (PKS) with an unknown function that may be specific to lichens.

"We identified numerous clusters of biosynthetic genes of unknown function, some of which are homologous to other genes involved in the biosynthesis of antibiotics and tox-ins, thus opening a novel avenue of research into new molecules in the pharmaceutical industry," reported Pradeep Divakar, another researcher in the Department of Pharmacology, Pharmacognosy and Botany.

Lichens are of great ecological importance. They have been widely used

as bio-indicators of air pollution and other factors because of their [high sensitivity](#) to [environmental changes](#), they form the basis of the food chain in specialized ecosystems and they are also an important nest-building resource for birds due to the antibacterial and antifungal activity of their secondary compounds.

"Another important function of lichens relates to soil formation, since they can prevent [soil erosion](#) and help maintain moisture, facilitating the establishment of vascular plants," concluded Pizarro.

More information: David Pizarro et al, Genome-Wide Analysis of Biosynthetic Gene Cluster Reveals Correlated Gene Loss with Absence of Usnic Acid in Lichen-Forming Fungi, *Genome Biology and Evolution* (2020). [DOI: 10.1093/gbe/evaa189](https://doi.org/10.1093/gbe/evaa189)

Provided by Universidad Complutense de Madrid

Citation: Scientists discover genes involved in a compound in lichens with antiviral activity (2020, December 11) retrieved 26 April 2024 from <https://phys.org/news/2020-12-scientists-genes-involved-compound-lichens.html>

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