Examining how bryophytes adapt without gibberellin

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Marchantia polymorpha growing in dense colonies near Kyoto University's Yoshida campus. Credit: KyotoU/Rui Sun

When life gets tough, nature usually finds a way to help the little guys.

Plants experience intense competition from their neighbors. To better survive restricted light conditions, it is common for both vascular plants and bryophytes—mosses and liverworts—to adjust their shapes and reproductive strategies. While grasses and flowers resolve this problem with the help of the plant hormone gibberellin, bryophytes lack the genes to do this.

Although bryophytes produce gibberellin precursors, their coping process is largely unknown.

A research team at Kyoto University has now revealed that the liverwort Marchantia polymorpha uses these precursors to produce a yet unidentified signaling molecule that helps M polymorpha readjust itself under shaded conditions.

Their study is published in *The Plant Cell* journal.

"Our research provides an interesting example of how a metabolic pathway was inherited from a common ancestor, a trait that later diverged into distant plant lineages," says corresponding author Takayuki Kohchi of KyotoU's Graduate School of Biostudies.

Using genetic tools, such as CRISPR-mediated editing, the team created multiple gibberellin synthesis-related mutants from different genes. All shared the same phenomenon: deficiency of the gibberellin biosynthesis pathway diminished the plant's response to far-red enriched light. Modified M polymorpha specimens did not grow upwards and become slender, nor did they accelerate sexual reproduction like the normal type.

"After finding that M polymorpha responded to the precursors, we used RNA sequencing to analyze the gene expression changes influenced by deficiencies in the gibberellin," explains first author Rui Sun, also from the Graduate School of Biostudies.

"Our ongoing investigation on gibberellin precursor response in liverworts may also shed light on the underlying mechanism of gibberellin-related compounds modulating their growth," concludes Kohchi.

More information: Rui Sun et al, Biosynthesis of gibberellin-related compounds modulates far-red light responses in the liverwort Marchantia polymorpha, *The Plant Cell* (2023). DOI: 10.1093/plcell/koad216

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