

Roots are capable of measuring heat on their own, new study shows

July 10 2023



Depending on the temperature, the plants have grown very differently. You can see the thale cress, vegetable cabbage and tomato (from left). Credit: Uni Halle / Carolin Delker

Plant roots have their own thermometer to measure the temperature of the soil around them and they adjust their growth accordingly. Through

extensive experiments, a team led by Martin Luther University Halle-Wittenberg (MLU), was able to demonstrate that roots have their own temperature sensing and response system.

In a new study in *The EMBO Journal*, the scientists also provide a new explanation for how roots themselves detect and react to higher temperatures. The results could help develop new approaches for plant breeding.

The researchers used climate chambers to investigate how the plant model organism thale cress and the two crops cabbage and tomatoes react to rising [ambient temperatures](#). They increased the ambient temperature from 20 to 28°C (68 to 82.4° Fahrenheit).

"Until now, it was assumed that the plant shoot controlled the process for the entire plant and acted as a long-distance transmitter that signaled to the [root](#) that it should alter its growth," says Professor Marcel Quint from the Institute of Agricultural and Nutritional Sciences at MLU. His team has now been able to disprove this through extensive experiments in cooperation with researchers from the Leibniz Institute of Plant Biochemistry (IPB), ETH Zurich and the Max Planck Institute for Plant Breeding Research in Cologne. In one experiment, scientists cut off the shoot of the plants but allowed the roots to continue to grow.

"We found that the roots were not affected by this and grew at elevated temperatures in the same way as on plants with intact shoots. The higher temperature stimulated [cell division](#) and the roots became significantly longer," says Quint. The team also used mutant plants whose shoots could no longer detect and respond to higher temperatures. Those were grafted onto roots without this defect. Here, too, the roots were able to react to the heat in the soil, even though the shoot did nothing.

The researchers found in all of their experiments that root cells increased

the production of the growth hormone auxin, which was then transported to the root tips. There, it stimulated cell division and enabled the roots to reach further down into the soil. "As heat and drought usually occur in tandem, it makes sense for the plants to tap into deeper and cooler soil layers that contain water," Quint explains.

Scientists have understood how plant shoots react to higher temperatures for some time. Their cells also produce more auxin, but the plant reacts differently than its roots. The cells in the shoot stretch, the stalk grows taller, and the leaves become narrower and grow farther apart.

The study also provides new insights for plant breeding. "In view of climate change, root growth is becoming more and more important for breeding. Understanding the [molecular basis](#) for temperature-dependent root growth might help to effectively equip plants against drought stress and achieve stable yields in the long term," says Quint.

Quint's team will continue its work in this field of research in the coming years.

More information: Haiyue Ai et al, Auxin-dependent regulation of cell division rates governs root thermomorphogenesis, *The EMBO Journal* (2023). [DOI: 10.15252/emboj.2022111926](https://doi.org/10.15252/emboj.2022111926)

Provided by Martin-Luther-Universität Halle-Wittenberg

Citation: Roots are capable of measuring heat on their own, new study shows (2023, July 10) retrieved 26 June 2024 from <https://phys.org/news/2023-07-roots-capable.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is

provided for information purposes only.