TROPICAL TREE GROWTH
No signs of stimulation
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Forest inventory data point to a CO2-induced stimulation of tree growth in the tropics, but direct evidence has been lacking. A tree-ring-based analysis spanning three continents suggests that tropical tree growth has remained stagnant on a centennial timescale, calling into question claims that old-growth tropical forests can help to soak up future CO2 emissions.

Peter van der Sleen, of Wageningen University, and colleagues examined changes in the growth and water-use efficiency of canopy and understorey trees in Bolivia, Cameroon and Thailand over the last 150 years using measurements of the width and stable carbon isotope signature of tree rings. In conjunction with a marked increase in intercellular CO2 concentrations, the researchers report a 30 to 35% increase in the water-use efficiency of the studied trees, indicative of a CO2-induced increase in photosynthesis, reduction in transpiration, or both. However, they find no evidence for a concomitant increase in tree growth.

Why increased concentrations of CO2 have failed to stimulate tree growth in the tropics remains unclear, but increasing temperatures, resource limitations and shifts in substrate allocation could hold the answer.

GENETICS
Cucumber’s bitter pill
Science 346, 1084–1088 (2014)

The bitter taste of cucumbers and squashes is due to cucurbitacins (CuCs), a class of triterpenoids involved in defence against herbivory. CuCs have been used in traditional medicine and possess cytotoxic and anticancer properties.

Yi Shang, of the Chinese Academy of Agricultural Sciences, and colleagues report a comprehensive genomic and biochemical study unravelling the pathway and regulatory mechanism underlying CuC biosynthesis. Through genome-wide association studies based on 115 cucumber lines, they mapped the previously reported Bi locus to the gene, CsA6G088690. Cucurbitadienol synthase activity of this gene was validated using yeast expression and gas chromatography–mass spectrometry assays. Analyses of mutants, gene expression patterns and genotype–phenotype association revealed two transcription factors, Bi (encoded by CsA5G156220) and Bt (CsA5G157230), binding to the Bi promoter, regulating its expression and, consequently, bitterness in leaves and fruits, respectively. Bt diversity has been reduced during the domestication of cucumbers, indicating that human selection has acted on this gene. A variation at Bt’s promoter is critical for its expression under stress. The researchers identified seven cytochrome P450s and one acetyltransferase whose genes cluster or are co-expressed with Bi, and regulated by Bi and Bt, which catalyse three of the reactions converting cucurbitadienol to CuC.

The CuC biosynthesis and regulatory networks, consisting of nine genes regulated by two transcription factors, could prove fertile ground for the engineering of anti-tumour drugs.

PLANT–MICROBE INTERACTIONS
Microbiome remote control

That the community of microbes associated with an organism affects its physiology is well established. But the distance over which these effects extend is underappreciated.

Studying lignin production in barley, Alison Bennett, of the James Hutton Institute, UK, and colleagues found that the soil microbiome has a stronger effect above ground than below it. They grew wild-type barley plants, and mutants impaired in their ability to synthesise lignin, on soils inoculated with two different microbial communities — one from a fertile agricultural land, the other from a nutrient-poor sand dune. Comparisons across the resulting eighteen treatments — six plant types and three soils, including sterile soil — found no effect of the plants grown on their colonization by soil microbes. However, the soil microbiome explained 6% of the lignin variation in roots and 21% of the variation in shoots, the most statistically significant effect the researchers detected.

Adjusting the properties of plants by grafting onto different rootstocks is commonplace; Bennett et al. have shown what is living on the roots deserves as much consideration as the roots themselves.

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