IMMUNITY

NLR population control

Cell Host Microbe **19,** 204–215 (2016)

The immune response in plants is costly because every cell defends itself, so it is only induced when pathogen presence is sensed through membrane or cytosolic receptors. NLRs are cellular sensors that perceive the presence or activity of pathogen effectors being delivered into the plant cell, initiating a strong immune response. If this control is lost, defence can be constitutively switched on and plants then suffer from autoimmunity, leading to dwarfed growth.

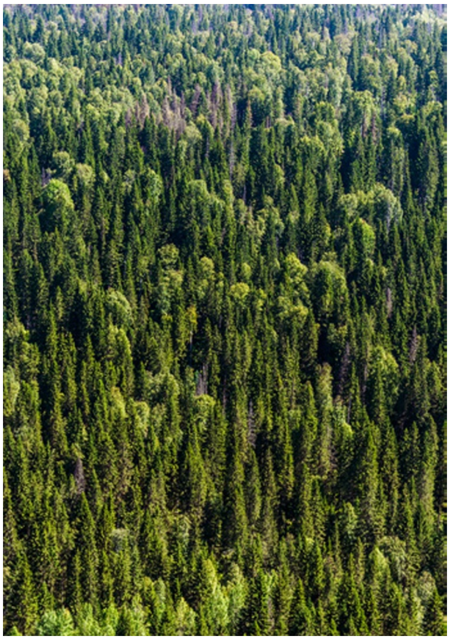
To find new immune regulators that may be difficult to discover in a wild-type background, Shuai Huang, Xin Li and colleagues from the University of British Columbia, Canada, searched for mutations that enhanced the autoimmune phenotype of the mutant *snc1*, in which the NLR protein SNC1 is stabilized. They identified two redundant TRAF-like proteins named MUSE. TRAFs are major players in animal immunity, and despite the large family in *Arabidopsis*, these proteins have been seldom studied in plants. A double *muse* mutant shows very severe autoimmune symptoms, confirming the role of MUSE proteins as negative regulators of immunity.

After an elegant series of genetic and molecular experiments, the authors concluded that, just like in animals, the two MUSE proteins mediate the formation of signalling complexes called TRAFasomes, which bring together NLRs and proteasome components. These complexes control NLR homeostasis, so that plants can choose between growth and defence. *GT*

PHOTOSYNTHESIS

Seasonal shift

Science **351,** 696–699 (2016)



The seasonal cycle of atmospheric CO_2 concentrations has grown more pronounced in the northern high latitudes over the past five decades, indicative of large-scale changes in terrestrial carbon fluxes. Model simulations suggest that an increase in plant carbon uptake is responsible.

Matthias Forkel, of the Max Planck Institute for Biogeochemistry, Germany, and colleagues use a global vegetation model, trained with satellite data, to assess the extent to which changes in vegetation dynamics can explain the latitude-dependent amplification of the seasonal CO_2 cycle. They find that an increase in net biome productivity, primarily in boreal and arctic ecosystems and underpinned by an increase in gross primary production, contributed significantly to the trend. The amplification disappeared in simulations in which climate or vegetation cover was held constant, suggesting that climate change and the shift from herbaceous vegetation to forests caused the increase in photosynthetic carbon uptake, and thus the amplification of the seasonal cycle, in northerly latitudes.

The researchers note that the climate-driven increase in plant productivity in the northern high latitudes is likely to subside at some point, due to resource and other limitations. *AA*

ECOPHYSIOLOGY

Desert roots

New Phytol. http://doi.org/bckt (2016)

Ephemeral roots — short-lived, non-woody roots situated at the edge of the root system — have been observed in temperate tree species, and are thought to play an important role in resource acquisition. But whether they occur more widely has remained unclear.

Bo Liu, of the Xinjiang Institute of Ecology and Geography, China, and colleagues probed for the presence of ephemeral roots in trees, shrubs and herbs common to the southern edge of the Taklamakan Desert. They grew the plants in a series of glass-walled chambers that they had constructed in the region, and monitored the morphology and longevity of the roots over the course of one and a half years. Ephemeral roots were apparent in all species studied.

Unlike perennial woody roots, the ephemeral roots lasted no more than four months, lacked secondary tissue and a continuous cork layer, and contained high concentrations of nitrogen. They were also more metabolically active, having high rates of respiration compared with the longer-lived roots.

The findings suggest that ephemeral roots may be common to perennial plants across a range of functional groups. *AA*

DEFENCE

Switching targets

Science **351,** 684–687 (2016)

To fight off infection, an organism must first recognize that it is under attack. Plants have a variety of mechanisms — that are often pathogen-specific — to identify invaders. Working at Indiana University, USA, Kim *et al.* have demonstrated how to change the specificity of a pathogen detection system so that plants can be made alert to new diseases.

One of the pathogen recognition systems in *Arabidopsis* involves RPS5, a nucleotide-binding leucine-rich repeat protein that indirectly provides resistance to the bacterium *Pseudomonas syringae*. Under normal circumstances, the kinase PBS1 represses RPS5, preventing a resistance response. However, PBS1 contains a sequence of amino acids that is targeted by a photolytic enzyme produced by *P. syringae*; so, in the presence of the pathogen, PBS1 is cleaved and deactivated, thereby allowing RPS5 to mount a defence response.

Kim *et al.* transgenically modified *Arabidopsis* plants so that their PBS1 proteins contained the target site for a protease from turnip mosaic virus (TuMV) instead of the *P. syringae*-sensitive sequence. When infected with TuMV, these transgenic plants displayed a type of resistance known as 'trailing necrosis', and also showed lower levels of virus accumulation than wild-type plants.

Redirecting the focus of a plant's defence systems in this way could provide an approach to swiftly proofing crops against newly emerging diseases. *CS*

Written by Anna Armstrong, Chris Surridge and Guillaume Tena