New insight into unique plant chemical could inform future drug development

December 12 2017

Researchers have unearthed new insight into a plant compound that could be used to help develop improved herbicides and treatments for human disease.

Their study, published in the journal *eLife*, addresses the question of how natural plant chemicals called glucosinolates (GSLs) evolve the ability to interact with genes in humans, insects, bacteria and other plants .

GSLs are evolutionarily young defence metabolites found in pungent plants such as mustard, cabbage and horseradish. They help the plant defend against insects and pathogens while also providing many of the flavours that we enjoy in these vegetables. The compounds are also the source of many protective nutritional benefits provided by the plants, due to their interaction with proteins in our bodies.

"Most pharmaceuticals are obtained from plants, suggesting that it is relatively common for plant compounds to interact with human genes," says first author Frederikke Malinovsky, Assistant Professor at the University of Copenhagen's DynaMo Center. "Looking at Arabidopsis thaliana, or thale cress, we wanted to discover exactly how such compounds evolve the ability to do this."

Recent work suggests that, when faced with environmental stress, plants may measure GSLs to quickly reallocate resources to coordinate plant growth and defense. Malinovsky and her team believed that if these

compounds can prompt changes in plant growth, this means they should have an inherent defence signalling capacity.

Using purified compounds, the team screened for signalling properties among GSLs by testing their ability to induce defence responses in Arabidopsis seedlings. They discovered that a unique GSL called 3-hydroxypropylglucosinolate (3OHPGSL) inhibits root growth in the plants.

"Feeding 3OHPGSL to a range of plants and baker's yeast led to altered growth in nearly all of these organisms," explains senior author Daniel Kliebenstein, DynaMo Center Partner and Professor in the Department of Plant Sciences at the University of California, Davis. "Using Arabidopsis mutants, we showed that this unique GSL influences the ancient and broadly shared TOR (Target of Rapamycin) complex, which controls metabolism in humans, yeast, plants and many other organisms. This is the first evidence that an evolutionarily young defense metabolite can regulate an ancient signalling pathway, and this may not be the only case where such an event occurs."

Kliebenstein adds that the ability of 3OHPGSL to affect the TOR complex could help in the development of new TOR-related drugs that may address a range of human diseases. Additionally, as the compound affects plant growth, it could be used in the creation of new and improved herbicides.

More information: Frederikke Gro Malinovsky et al, An evolutionary young defense metabolite influences the root growth of plants via the ancient TOR signaling pathway, *eLife* (2017). DOI: 10.7554/eLife.29353

Provided by eLife