A gene from a wild crop relative constitutes a novel pest resistance mechanism

Plant-parasitic nematodes are major pests in agriculture and horticulture. Global economic losses by plant-parasitic nematodes are estimated to be around 157 billion USD annually. Treatment with nematicides is still widely applied. However, due to their toxicity and soil persistence, they pose a risk to humans and the environment. Therefore, growing resistant varieties is an environmentally friendly solution to control nematode infections.

The beet cyst nematode is the most important pest in sugar beet production. The *Hs4* gene from a distantly related wild species is the only resistance source. This gene has been identified from a group of the Plant Breeding Institute; Christian-Albrechts-University of Kiel headed by Prof. Christian Jung. The results are published in the journal New Phytologist. The gene was mapped to a short genomic region using irradiation mutants. Knockout in resistant beets resulted in complete susceptibility whereas overexpression turned susceptibility into resistance. The gene encodes a rhomboid-like protease. Proteases degrade other proteins which can substantially alter the cell's function. The function of rhomboid-like proteases in a resistance reaction has not been described before.

Cloning the gene marks the end of a study lasting for more than 30 years. It could be found only after modern techniques like next-generation sequencing and CRISPR-Cas-mutagenesis in combination with novel bioinformatics tools became available in the past years. The *Hs4* gene offers new perspectives for breeding resistant varieties. It is expected that the *Hs4* gene functions as a nematode resistance gene not only in sugar beet but also in other crops.