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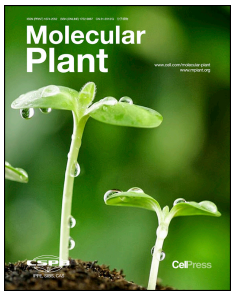


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# Crip21-Alert from Dodder to Crops

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Together with pathogenic microbes and herbivorous insects, parasitic plants are emerging as aggressive threats on agriculture worldwide. Among them, *Cuscuta* (dodder), a stem holoparasite, extracts nutrients and water from host plant through phloem-feeding. Dodder is parasitic on a very wide variety of plants, including a number of important agricultural and horticultural crops such as alfalfa, clover, tomatoes and potatoes. Dodder infestations cause major economic concerns including crop yield reduction and cost increase of crop harvesting. Understanding resistance mechanisms against dodder can provide potential solutions to effectively control dodder infestations.

A recent study from the Albert lab and their collaborators demonstrated that a cell wall protein from dodder can be specifically recognized by a tomato receptor Cuscuta receptor 1 (CuRe1) (Hegenauer et al., 2020). Previous work from the same lab revealed that plasma-membrane localized CuRe1 is a critical component in detecting *Cuscuta reflexa* (*C. reflexa*) (Hegenauer et al., 2016). To further illuminate how host plant recognizes *C. reflexa*, researchers purified and identified the Cuscuta factor from the cell wall extract of *C. reflexa*, which triggers defence responses in cultivated tomato (*Solanum lycopersicum*) (Hegenauer et al., 2020). Using LC-MS/MS, Cuscuta factor is identified as a glycine-rich protein (GRP) of *C. reflexa* (CrGRP) consisting of 116 amino acids. Expressing CrGRP in *Nicotiana benthamiana* leaves results in hypersensitive cell death when CuRe1 is present, indicating CrGRP is recognized by CuRe1 to trigger defence responses (Figure 1).

Direct interactions between a 29-amino acid (aa)-long peptide (crip29) of the CrGRP and the CuRe1 receptor were confirmed by affinity-crosslinking experiments in *Nicotiana benthamiana* leaves. Further analyses identified a 21-aa-peptide (crip21) as the minimal peptide epitope of CrGRP to trigger defence responses. Individual site-mutagenesis analysis showed that four cysteine residues at position 7, 17, 20 and 21 contribute to CuRe1 activation. Interestingly, based on comparing crip21 sequence to homologous regions from GRPs in other Cuscuta species and some non-parasitic plants, researchers are able to show that a single amino acid change of alanine 11 to tyrosine in crip21 completely abolishes CuRe1-dependent crip21 activity.

While plant GRPs are shown to be functionally diverse, multiple studies have reported their roles in cell wall stabilization (Mangeon et al., 2010). The discovery of crip21 as a molecular pattern recognized by plant surface receptor CuRe1 significantly boosts the understanding of interactions between host and parasitic plants. Further studies on crip21-CuRe1 pathways can potentially guide resistance engineering against parasitic plants.

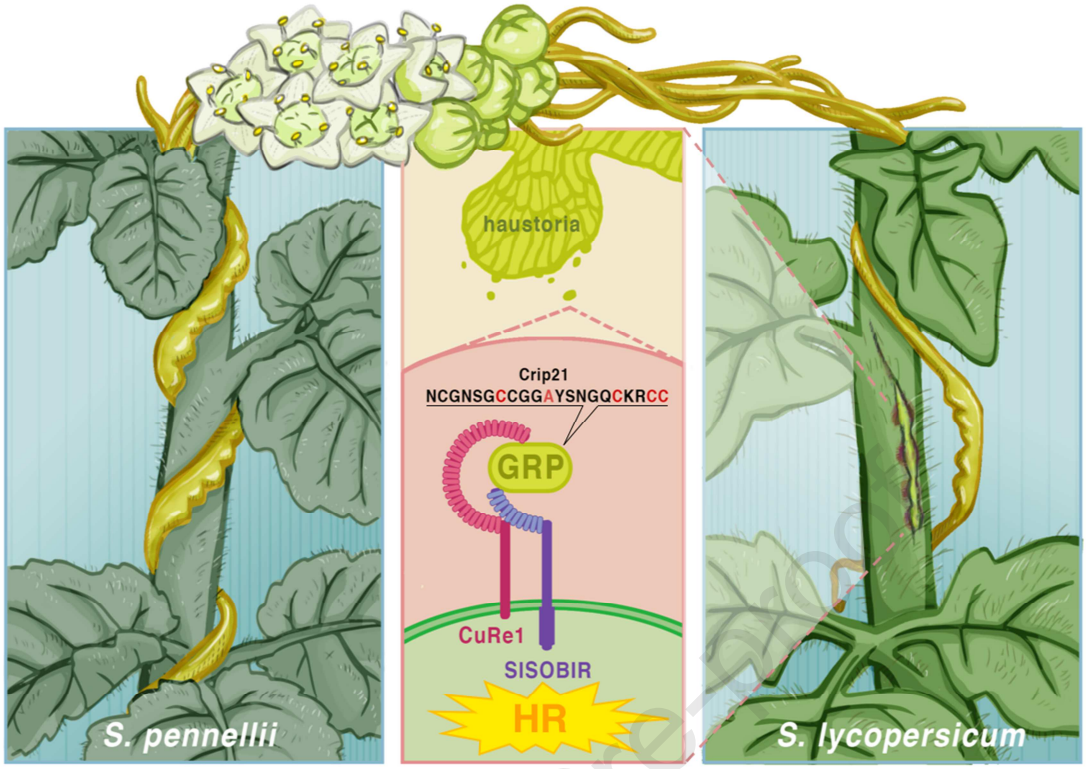


Figure 1. crip21 recognition by CuRe1 confers resistance to *C. reflexa* in cultivated tomato (*Solanum lycopersicum*).
While susceptible tomato cultivar (*Solanum pennellii*) remains insensitive to *C. reflexa*, in resistant tomato cultivar (*Solanum lycopersicum*), crip21, derived from cell wall of *C. reflexa*, is recognized by surface receptor complex CuRe1 and SOBIR families (suppressor of BAK1-interacting receptor kinase) leading to hypotensive responses (HR).

Reference

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