

Magnesium and calcium over-accumulate in the leaves of a *B. rapa* mutant

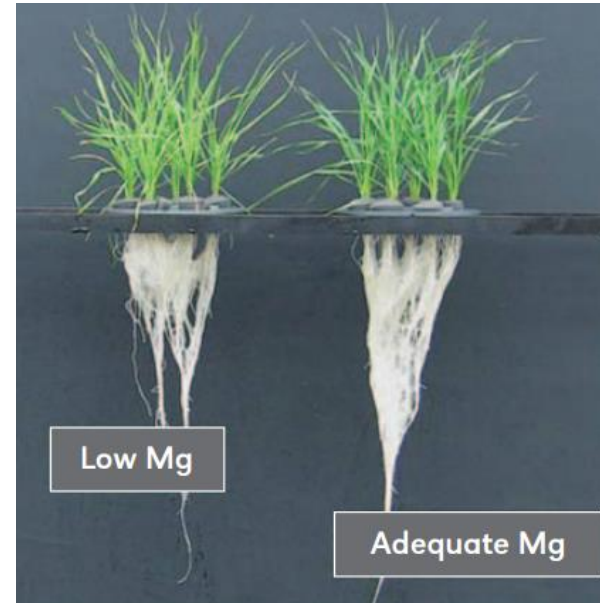
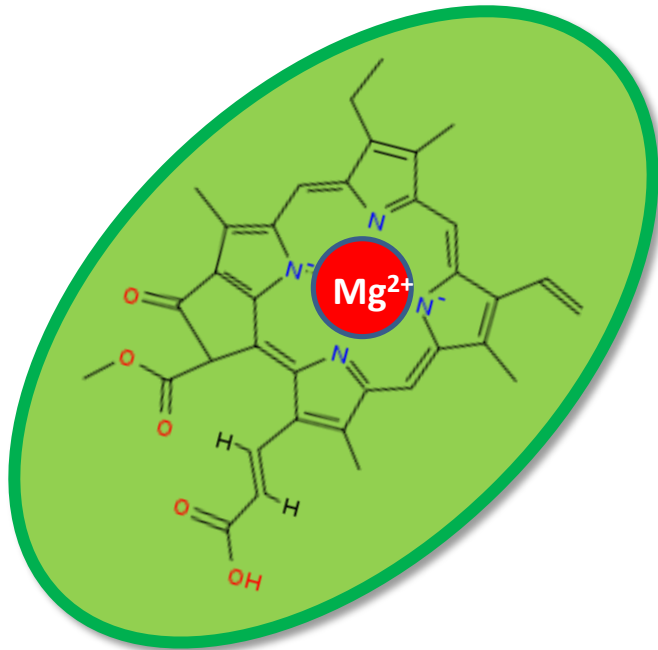
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Magnesium (Mg) “a forgotten element”



Mg concentrations in edible crops reported to be 35% lower in 1980s than in 1930s

Magnesium (Mg) “*a forgotten element*”

- **Around 38 % teenagers and 12 % adults deficient in Mg (UK)**
- **Girls aged 11-18 consume on average 67% RNI of Mg (UK)**

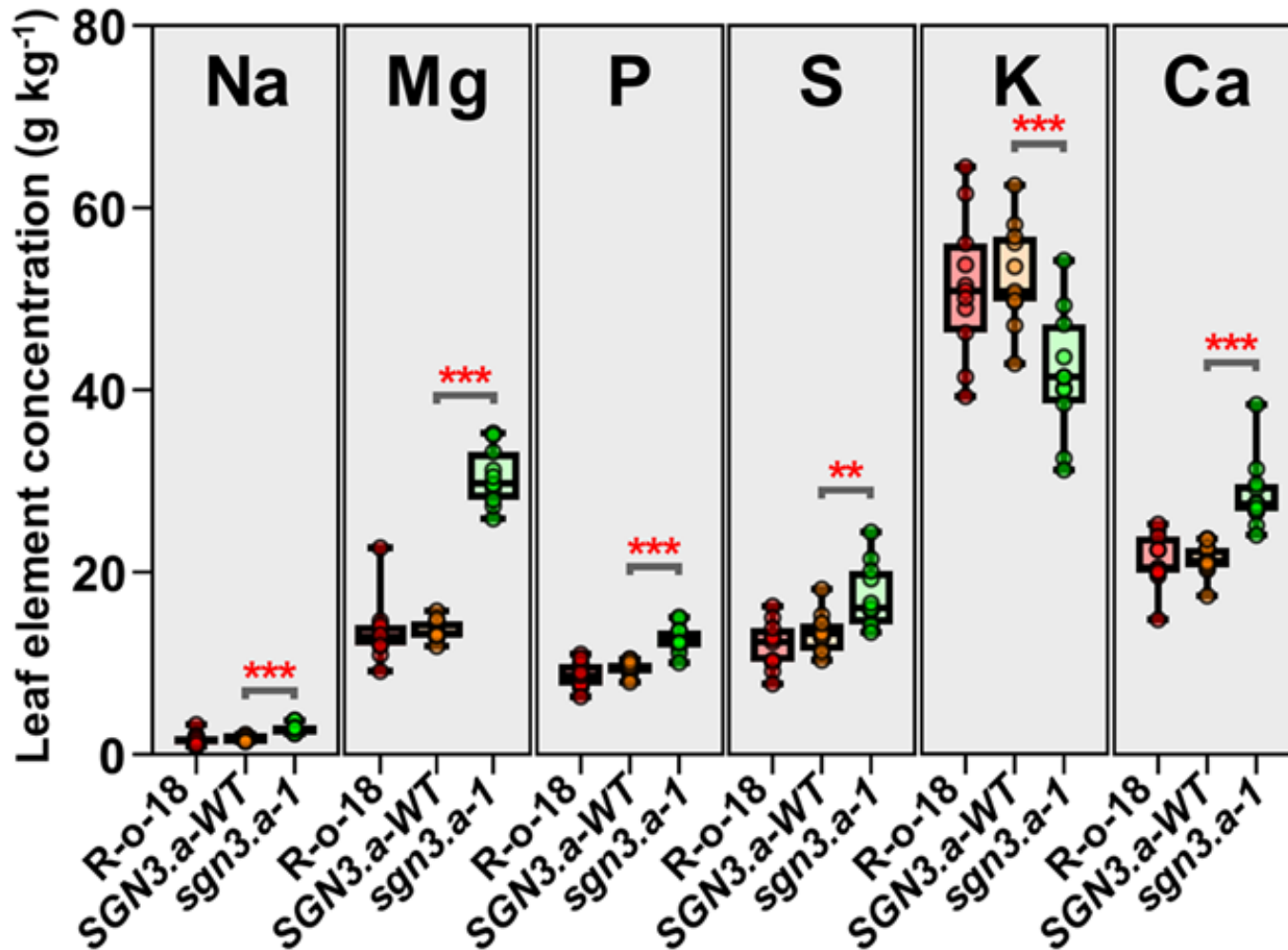
(National Dietary and Nutrition Survey 2012/13 – 2013/14)

- **Deficiencies can lead to muscle tremors/cramps, fatigue, irritability, irregular/rapid heartbeat**
- **Biofortification of edible crops with Mg is a viable solution**

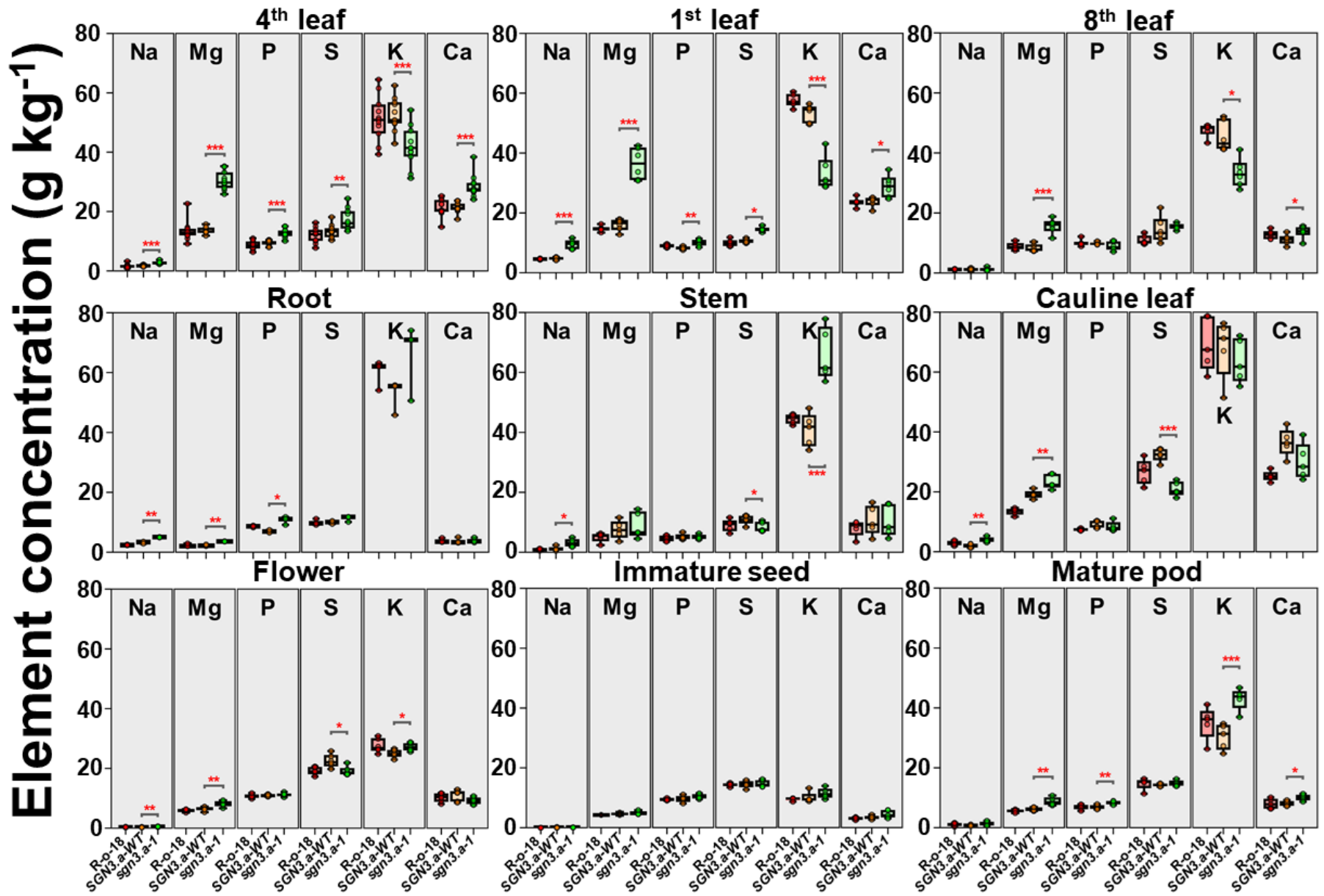
(Broadley and White. 2009. New Phytologist 182: 49-84)

Identifying Mg mutant

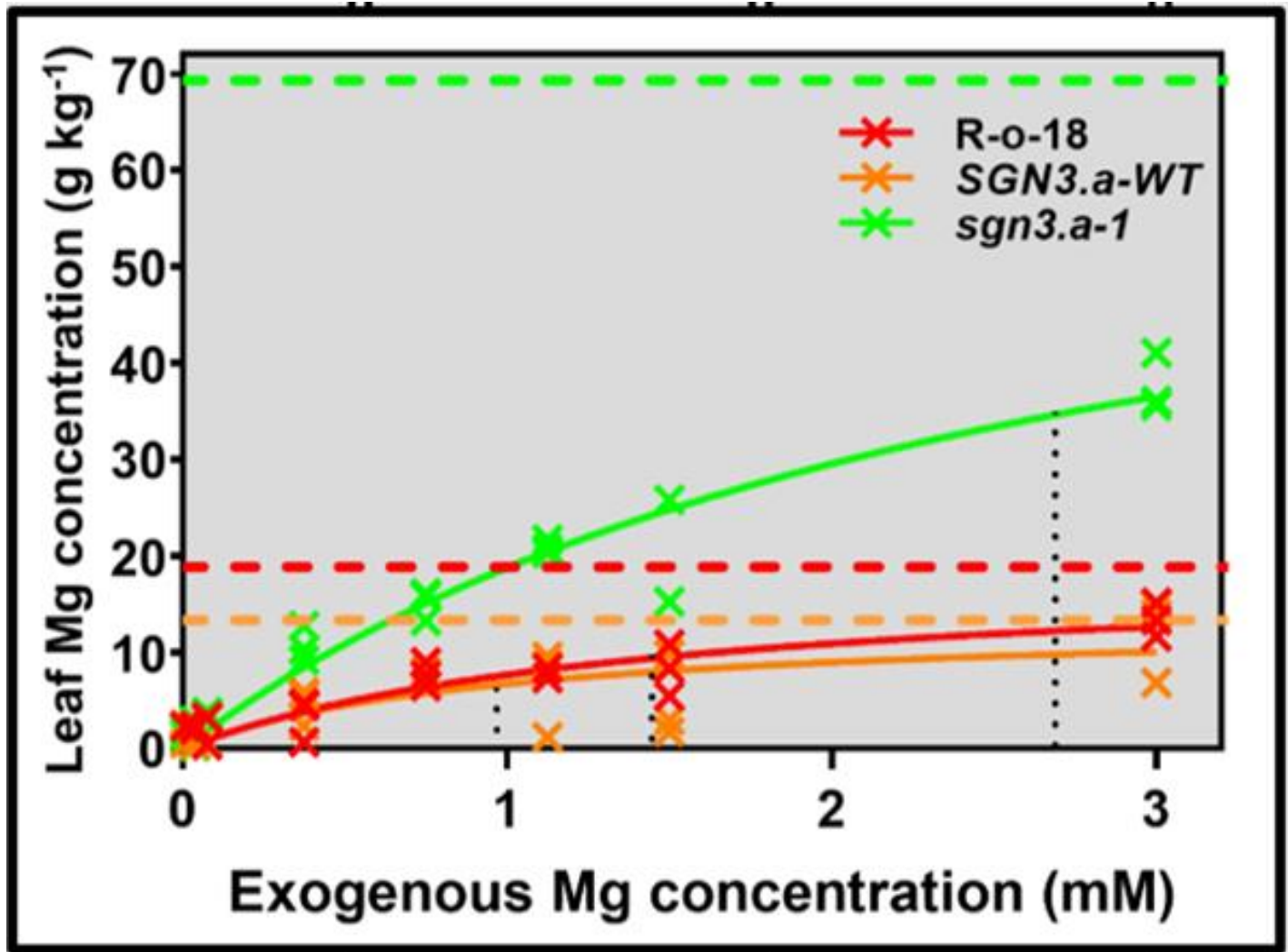
- Screened *Brassica rapa* population for mineral content
- Line identified with high Mg leaf content



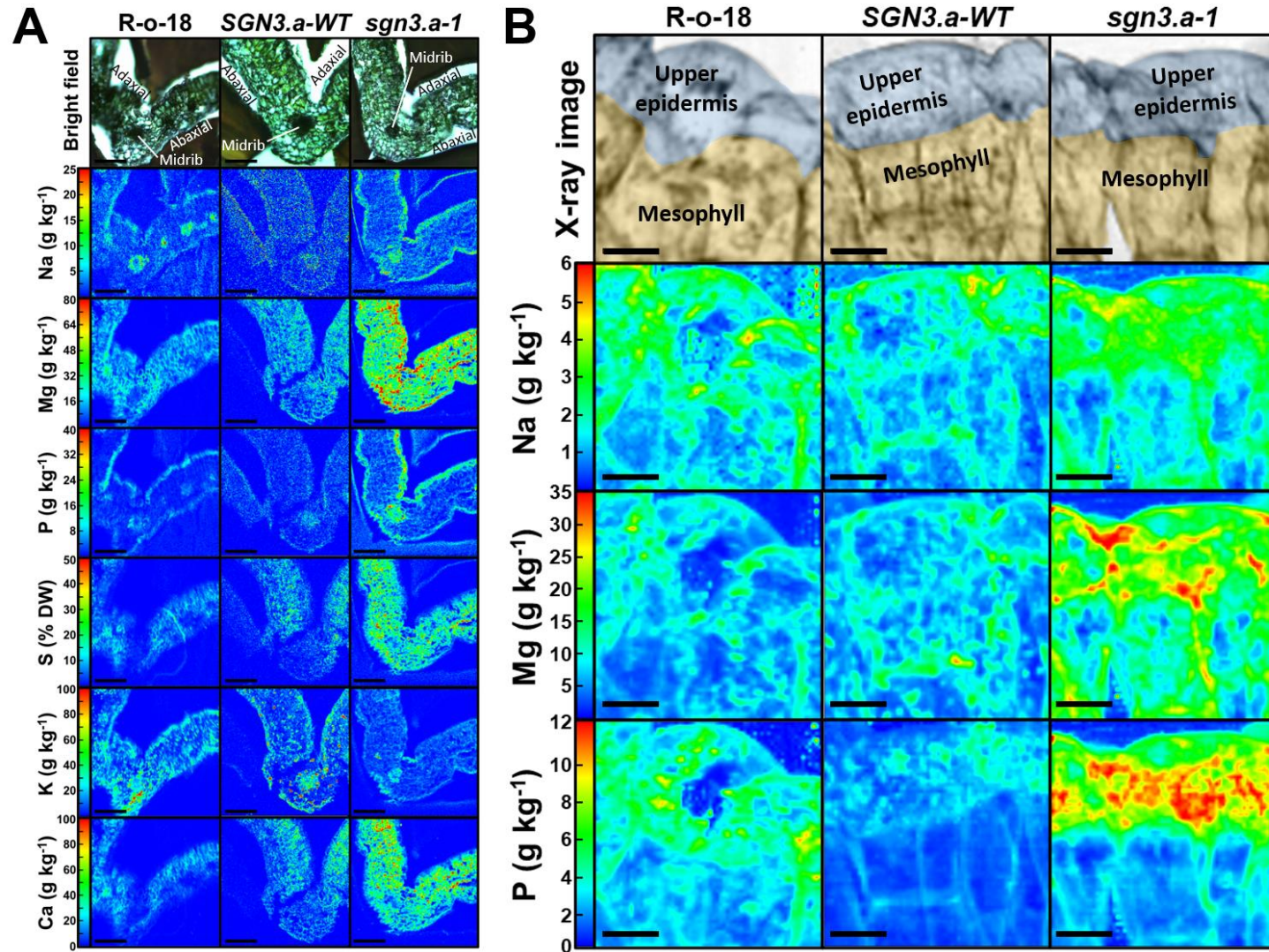
Altered in different tissues



Mutant responds to external Mg

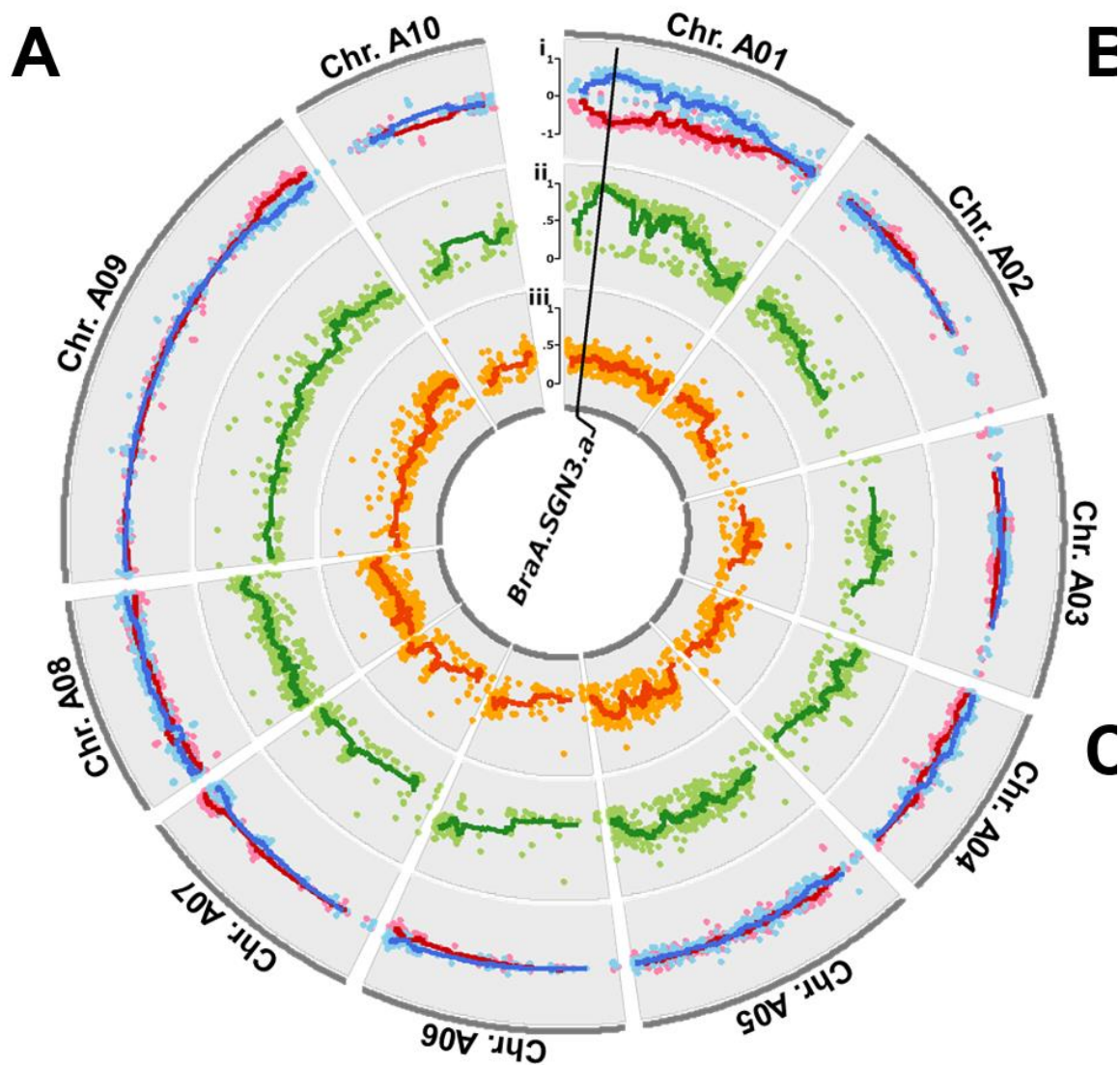


Mg accumulates in leaves



A. Quantified spatial distributions of sodium (Na) magnesium (Mg), phosphorus (P), sulphur (S), potassium (K) and calcium (Ca) in representative first or second leaves of R-o-18, *BraA.SGN3.a-WT* (*SGN3.a-WT*) and *braA.sgn3.a-1* (*sgn3.a-1*) as analysed by micro-proton induced X-ray emission (μ PIXE). Scale bar = 200 μ m. **b.** Spatial distributions of Na, Mg and P in upper epidermal and mesophyll cells of R-o-18, *SGN3.a-WT* and *sgn3.a-1* as analysed by X-ray fluorescence. Upper epidermal (blue) and mesophyll cells (orange) indicated on X-ray image. Scale bar = 20 μ m.

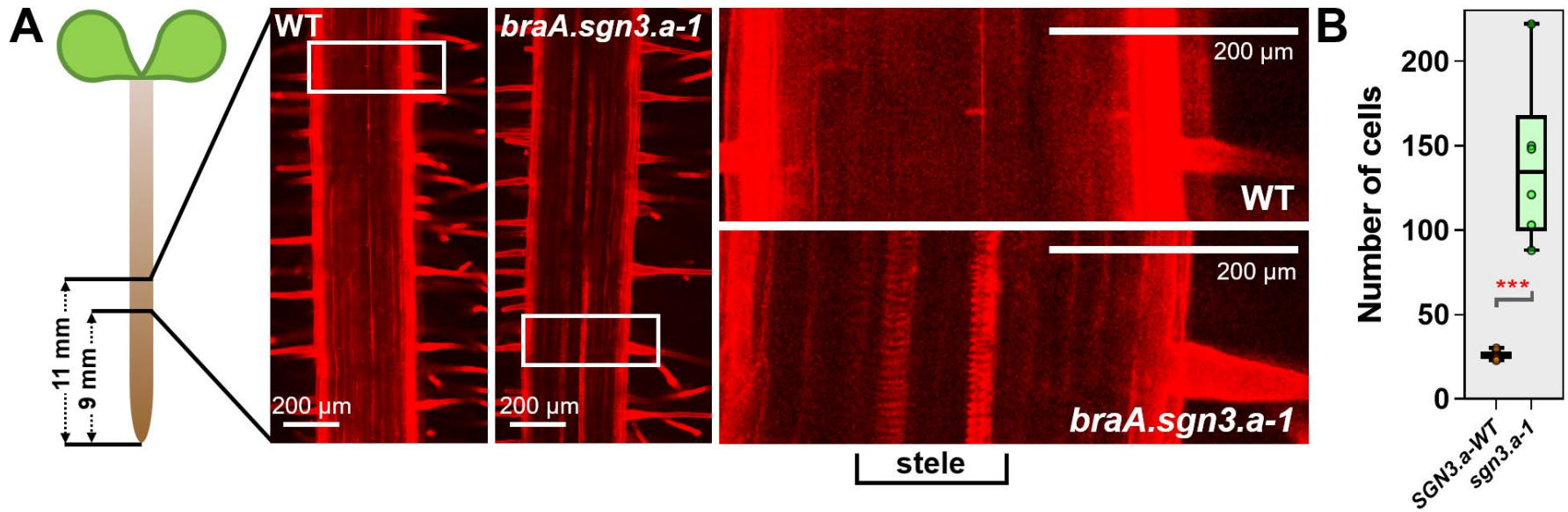
Mapped gene responsible to *BraA.SGN3*

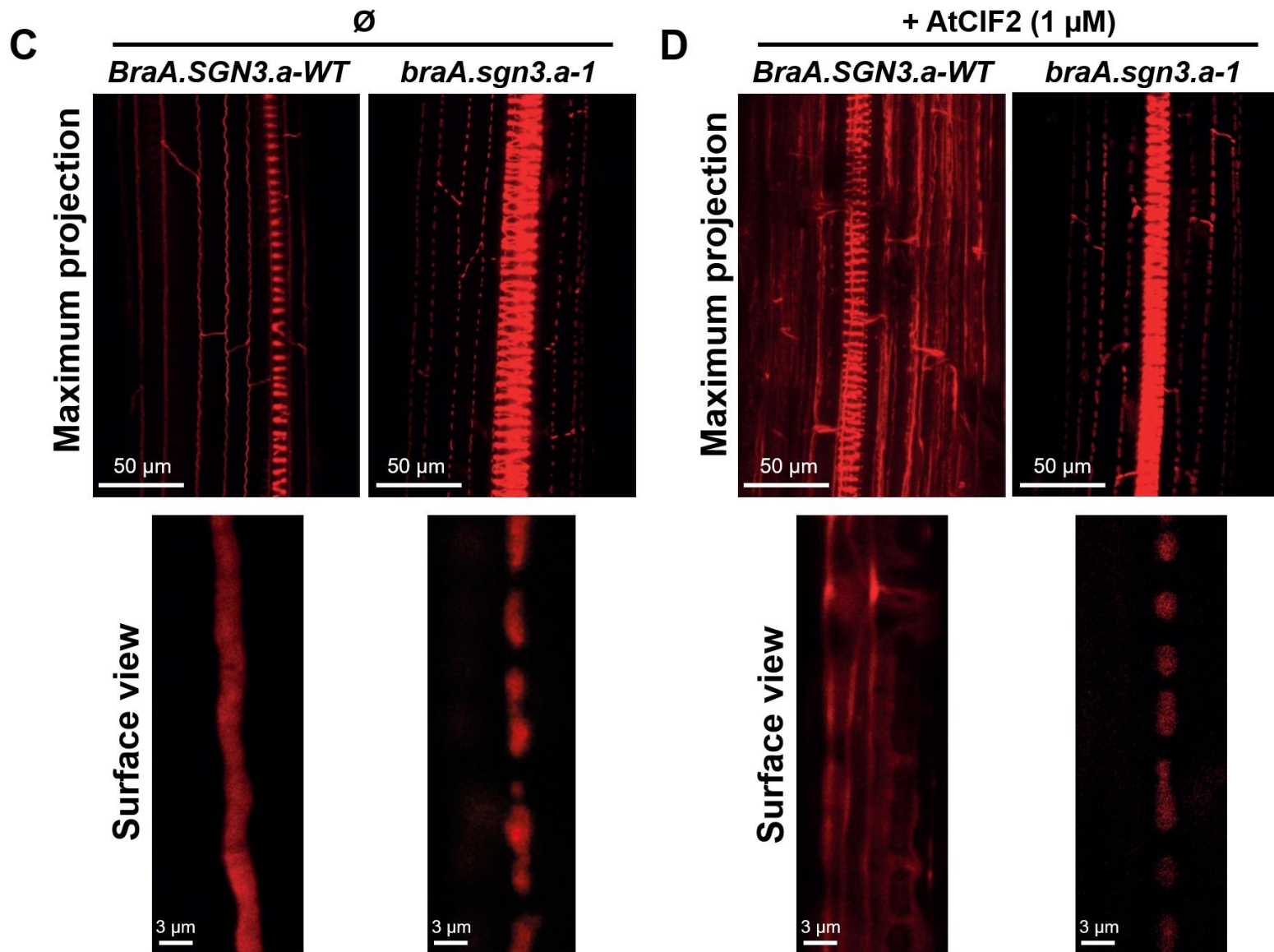


i = Delta SNP Index. ii = High Mg SNP index. iii = Low mg SNP index

Mutant has defects in Casparian strip

Propidium iodide staining





C. 4 day old roots stained with the lignin stain Basic Fuchsin. Non-contiguous lignin band in *braA.sgn3.a-1*, indicating a disrupted endodermal barrier. D. presence of exogenous AtCIF2 peptide. Note ectopic lignin deposits in roots of *BraA.SGN3.a-WT* in the presence of AtCIF2, whereas *braA.sgn3.a-1* fails to show a similar response.

Conclusions

- Mutant isolated from TILING population
- Increased Mg and Ca levels in leaves
- Maps to *BraA.SGN3*
- Has defects in Casparian strip formation

Acknowledgements



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