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# Transfer and toxicity of atmospheric urban particles to edible vegetables: Evidence of the role of epicuticular waxes

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## Context and objectives

Metal-rich fine particles

Transportation

Emissions

Deposition on vegetable leaves

Accumulation/foliar Transfert foliaire of metals

Edible vegetables cultivated in urban Area

2 main issues

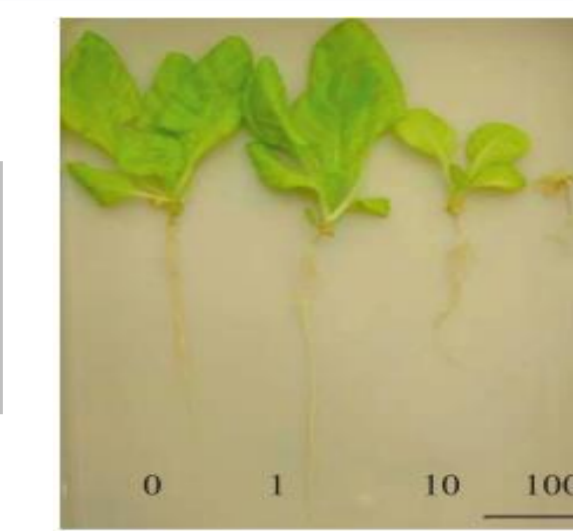
- Physiological impacts on vegetables and biodiversity changes
- Quality of vegetables for fooding

objectives

Investigating the phytotoxicity induced by foliar transfer of atmospheric particles through the evaluation of:

- the photosynthetic activity
- The genotoxicity
- The gene expression levels

Investigating the influence of time exposure and particle composition



Monteiro et al., 2012



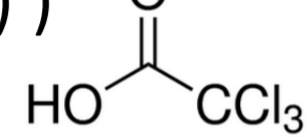
## Methodology

### Sample preparation



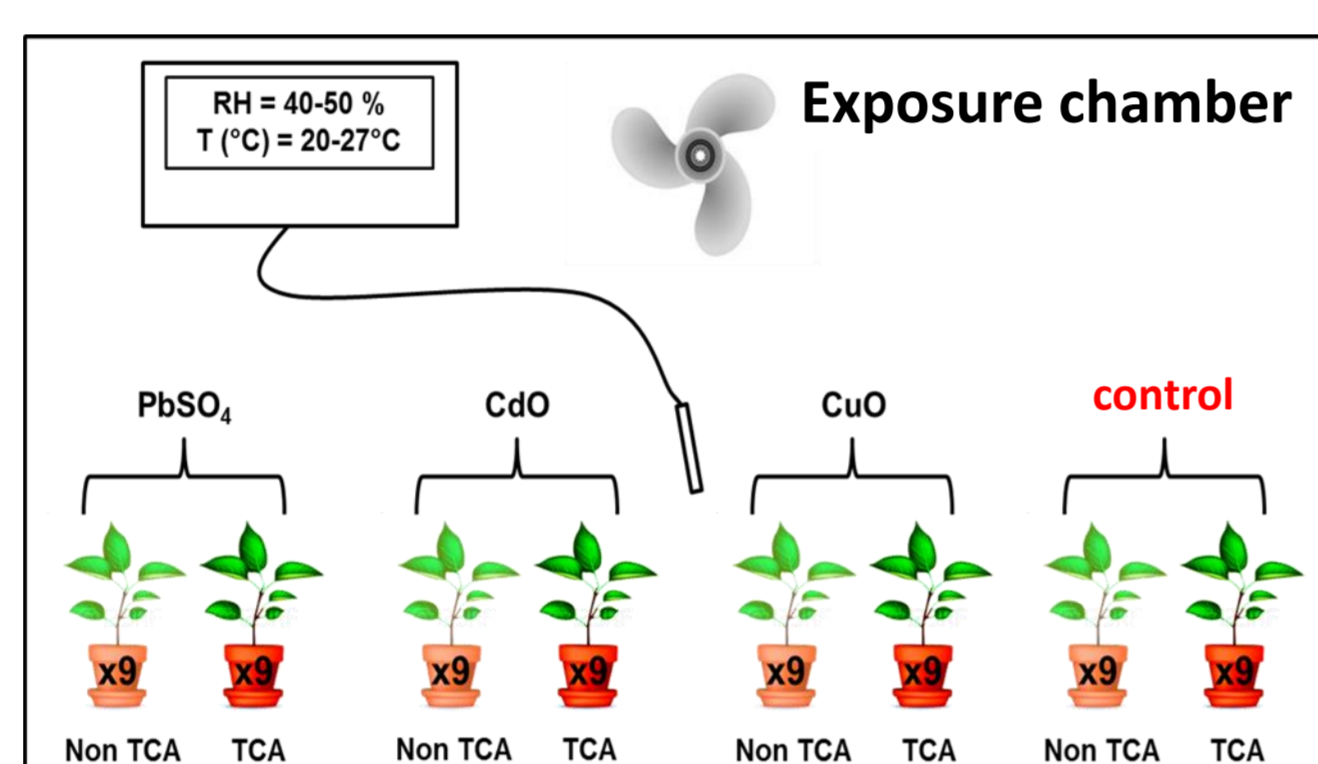
(*Brassica oleracea* var. Prover)

Chemical treatment using trichloroacetic acid (TCA: 10<sup>-4</sup> M (g/g))



Epicuticular wax reduction of 60%

### Sample exposure



- Dry deposit of CdO, CuO and PbSO<sub>4</sub> on adaxial part of the leaf
- Estimated covering rate 1-1,5% of the leaf surface
- 5, 10 and 15 days of exposure

### Sample analysis

#### Leaf surface and cross section analysis

- ☐ SEM-EDX
- ☐ Raman Microspectrometry

#### PSII Chl fluorescence (Fv/Fm parameters)

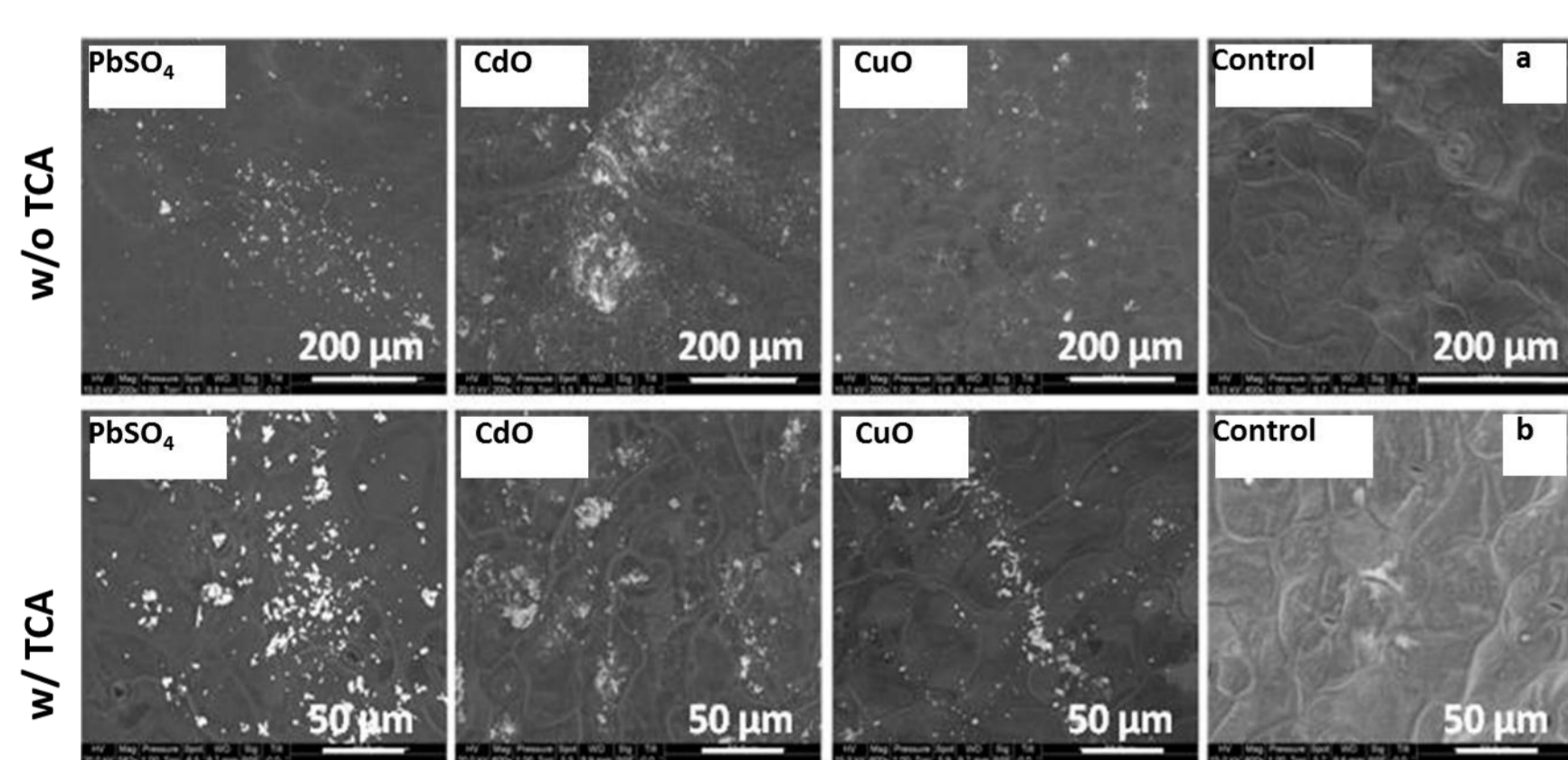
#### Comet assay

#### Real-time quantitative PCR (qPCR) procedure

- Particle location and characterization of particle transfer
- Photoactivity and physiological effects
- %DNA damage and genotoxicity
- FSD1, CHL11 and OGG1 genes expression

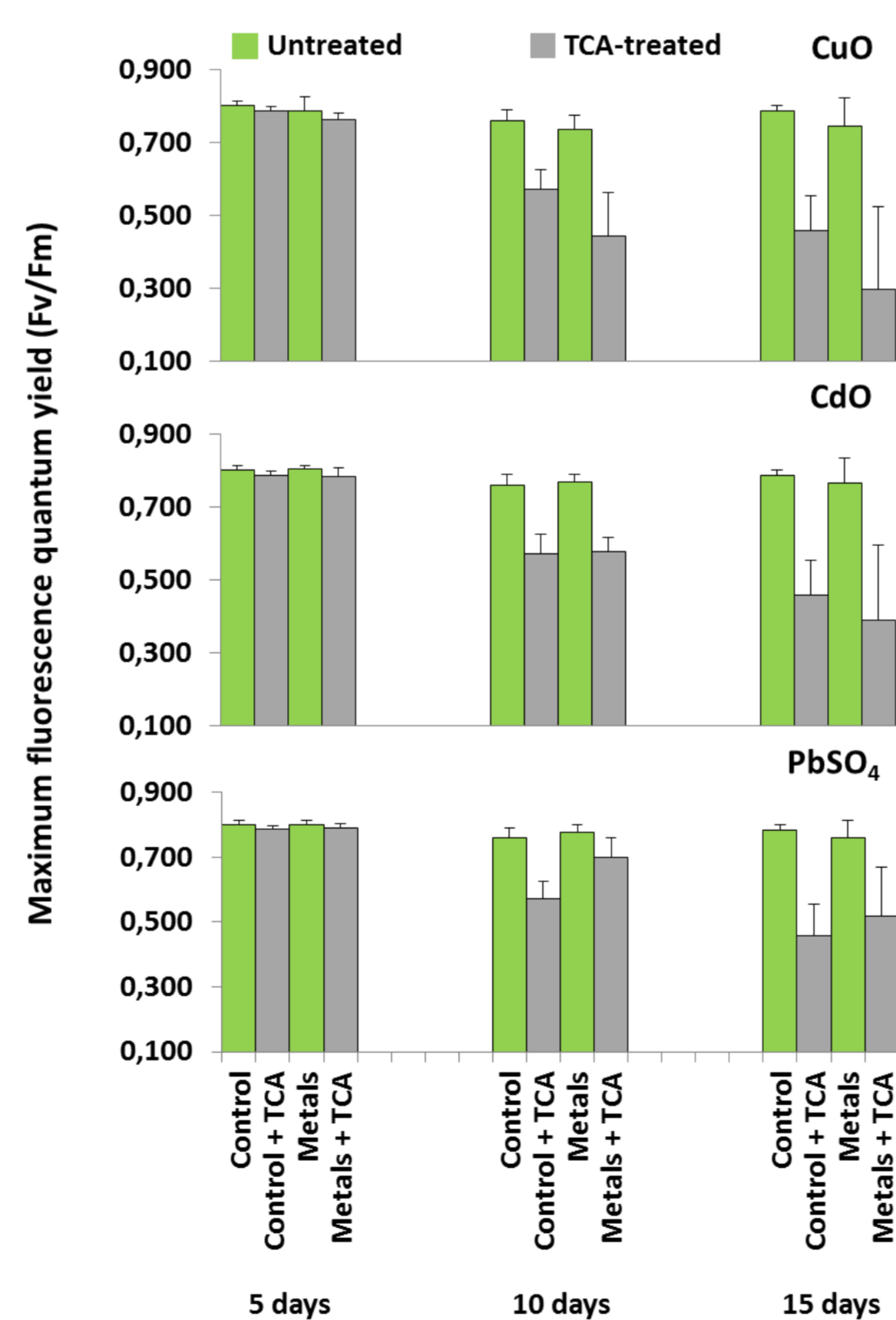
## Results

### Metal accumulation within the leaves (VALEUR ?) and particle trapping into cuticular wax



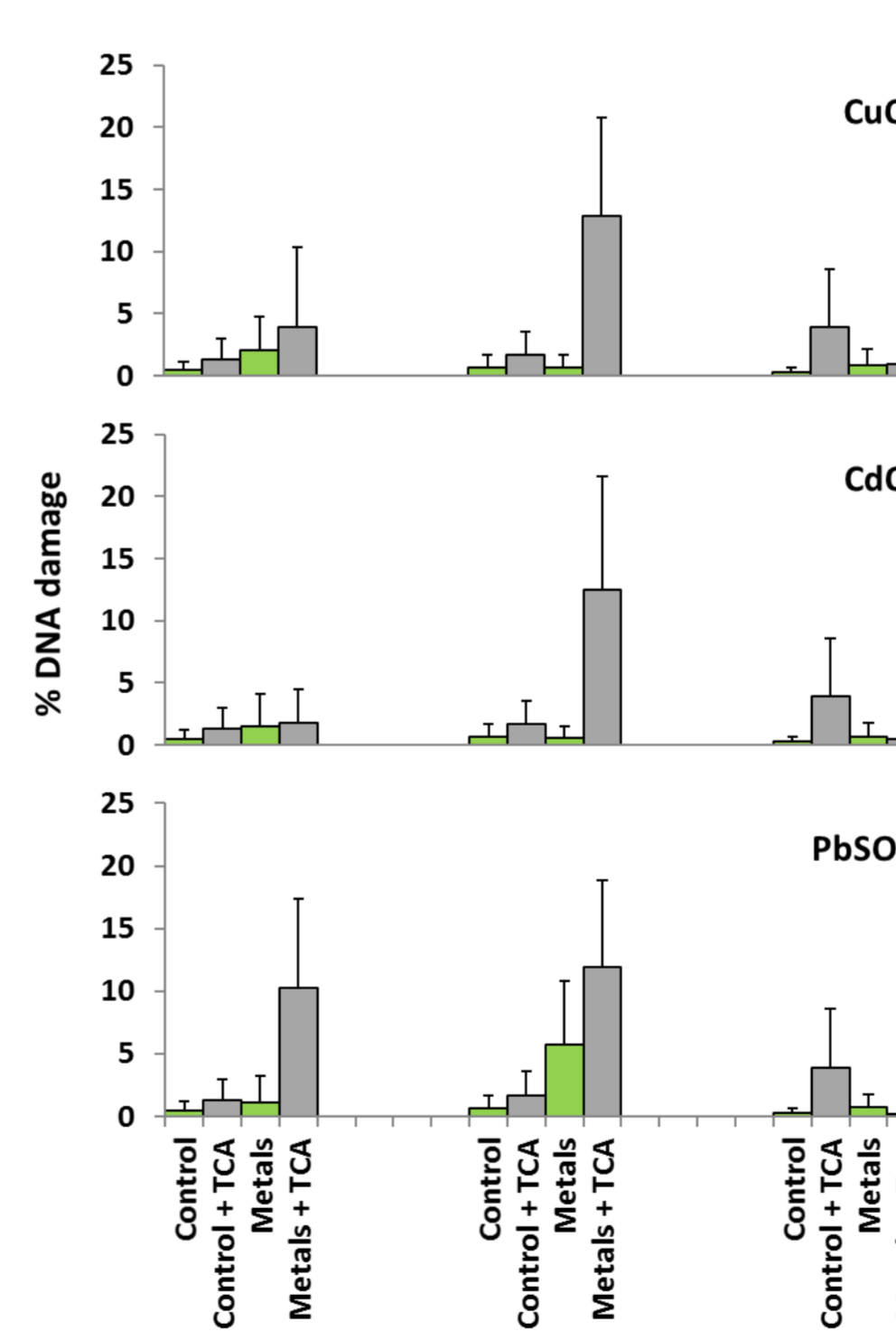
Je ne vois pas sur les images en coupe les particules – le spectre EDX n'est pas parlant Spectre Raman ?

### PSII Chl fluorescence



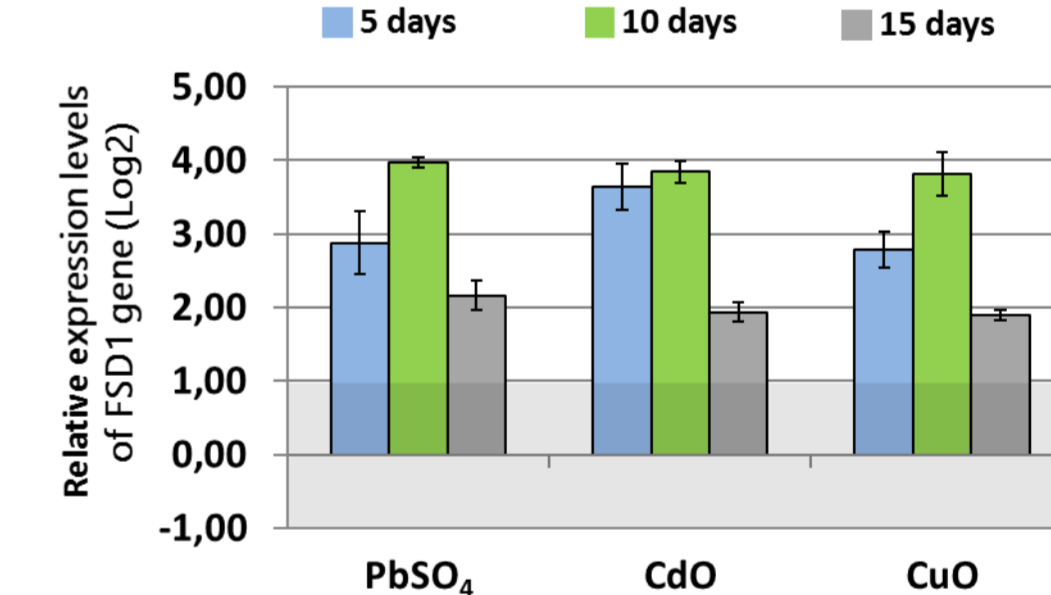
- Impact for CuO > CdO > PbSO<sub>4</sub>
- Pronounced for TCA-treated plants
- Influence of the time exposure

### Cellular toxicity (Comet assay)

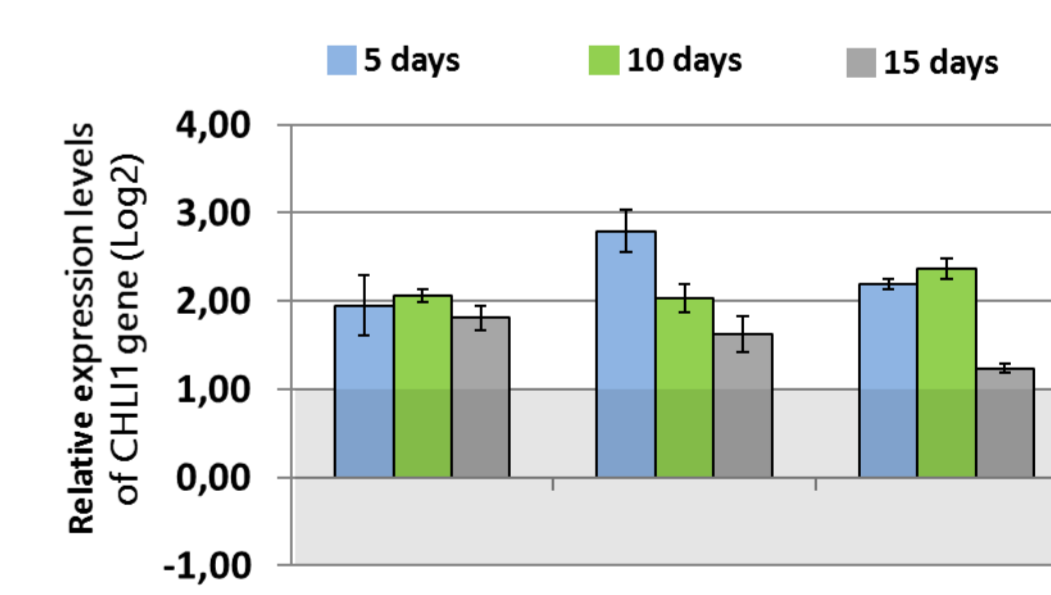


- genotoxic effects are significant for TCA-treated plants
- More pronounced for PbSO<sub>4</sub>
- Repair mechanisms

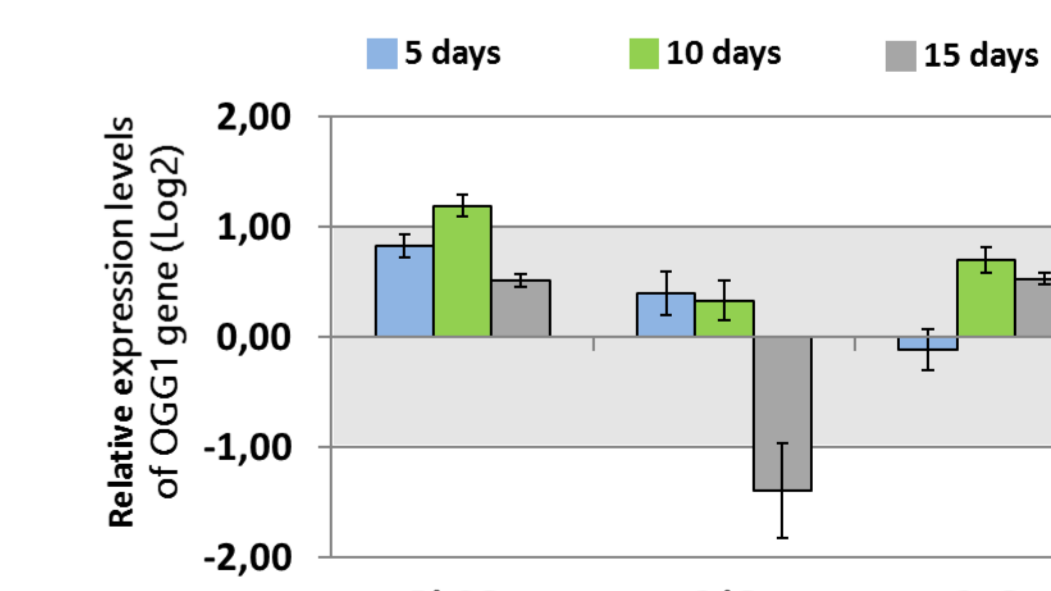
### Relative expression levels of genes



CHL11 overexpressed for each condition due to stomatal sealing

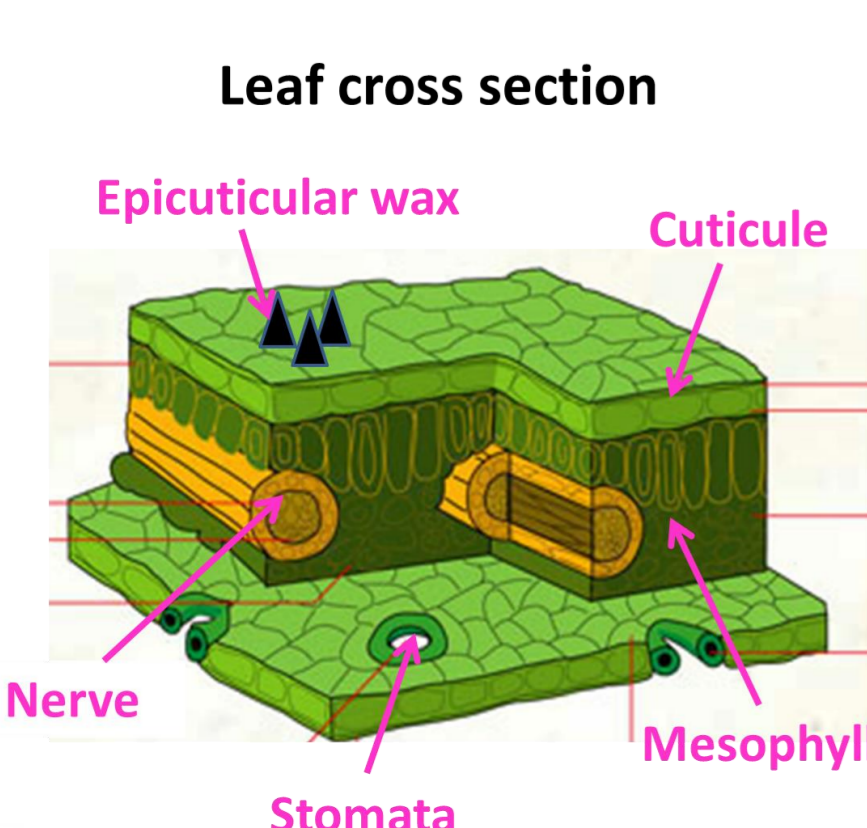


Oxidative stress limitation Repair mechanisms for CdO and CuO ??



No obvious oxidative stress

## Conclusion



**Metal-rich particles are trapped by adaxial face of leaves in case of atmospheric exposure. It appears that the transfer through the stomatae induces a PSII activity decrease. The DNA damage xxx Oxidative stress ????**  
The results clearly showed the role of epicuticular wax to limit the metal transfer and the genotoxic effects.

## Acknowledgments

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