The Role of *Rhizophagus irregularis* in the Mercury Tolerance of *Medicago truncatula*

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Rhizophagus irregularis improves Hg tolerance of *Medicago truncatula* by upregulating the Zn transporter genes ZIP2 and ZIP6

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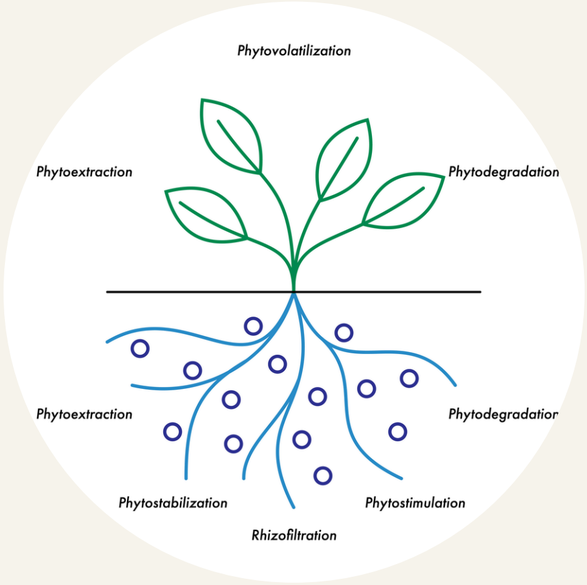
DEFINITIONS

Rhizophagus irregularis

- Fungus found in soil and roots
- Used as soil inoculant



Phytoremediation

- Process where plants and microbes remove contaminants from soil, water and air

Medicago truncatula

- Small clover-like plant
- Symbiotic with *R. irregularis*

HYPOTHESIS

Does R. irregularis affect Zn uptake in M. trucatula under Hg exposure?

1. Does *R. irregularis* affect biomass and Hg accumulation of *M. trucatula* under Hg exposure?

2. How does Hg move across roots, stems, and leaves of *M. truncatula* associated with *R. irregularis*?

3. What effects does *R. irregularis* have on Zn nutrient uptake and Zn transporters under Hg exposure?

METHODS

Experimental Design

- Plants were grown in a greenhouse in separate pots
- A 2 × 3 complete factorial design, with 5 replications per treatment arranged in a randomized block design

Treatments

- Single dose of 5 ml $HgCl_2$ at concentrations of 25 µg g^{-1} or 50 µg g^{-1}
- Lasted 5 weeks after Hg exposure

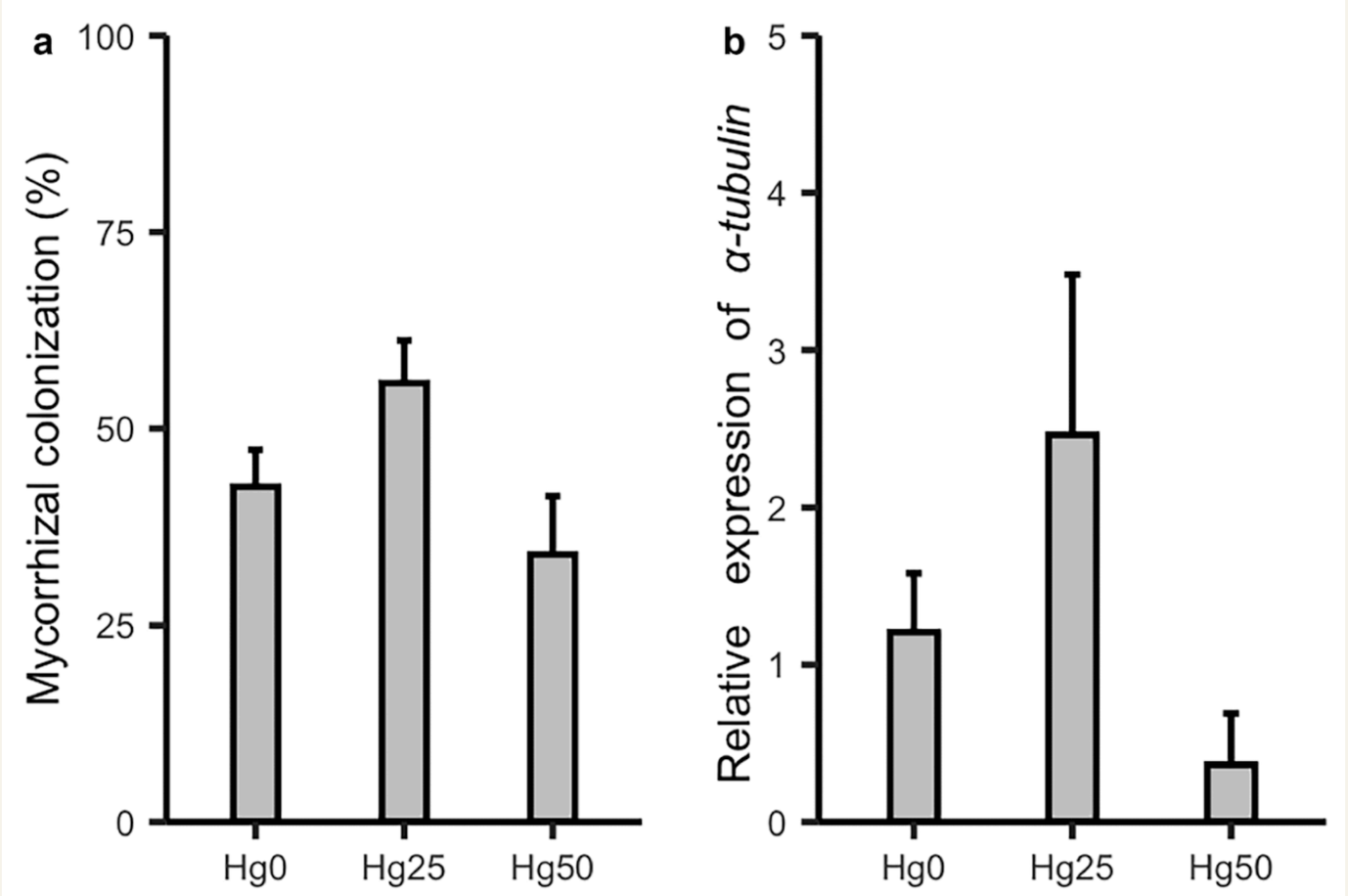
No significant effect of Hg treatment on *R. irregularis* root colonization or α-tubulin expression

Statistical info

- Mixed-model ANOVA
- Tukey test

Values

- p>0.05



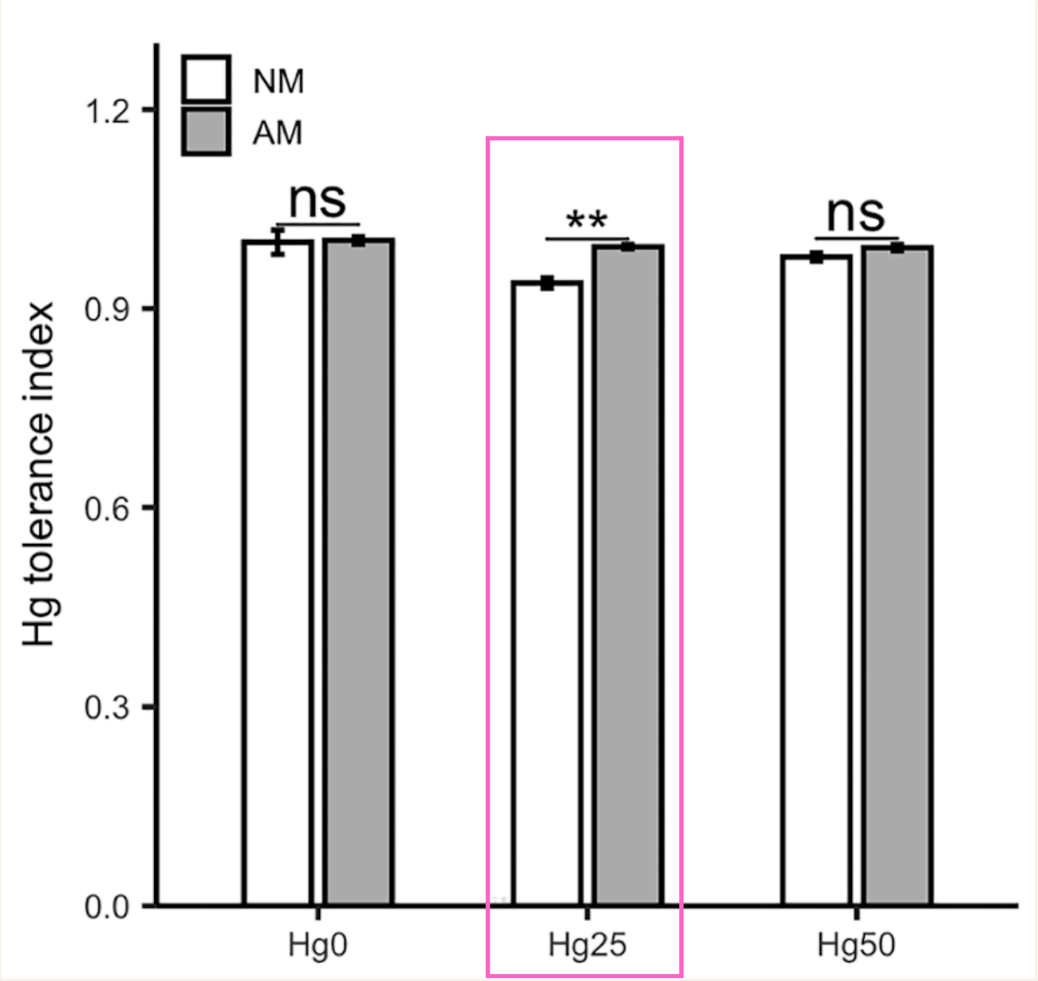
R. irregularis significantly increases *M. truncatula* tolerance of Hg

Statistical parameters

- T-test
- Box-Cot transformation

Values

- Hg25 has a p<0.01



How does this happen?

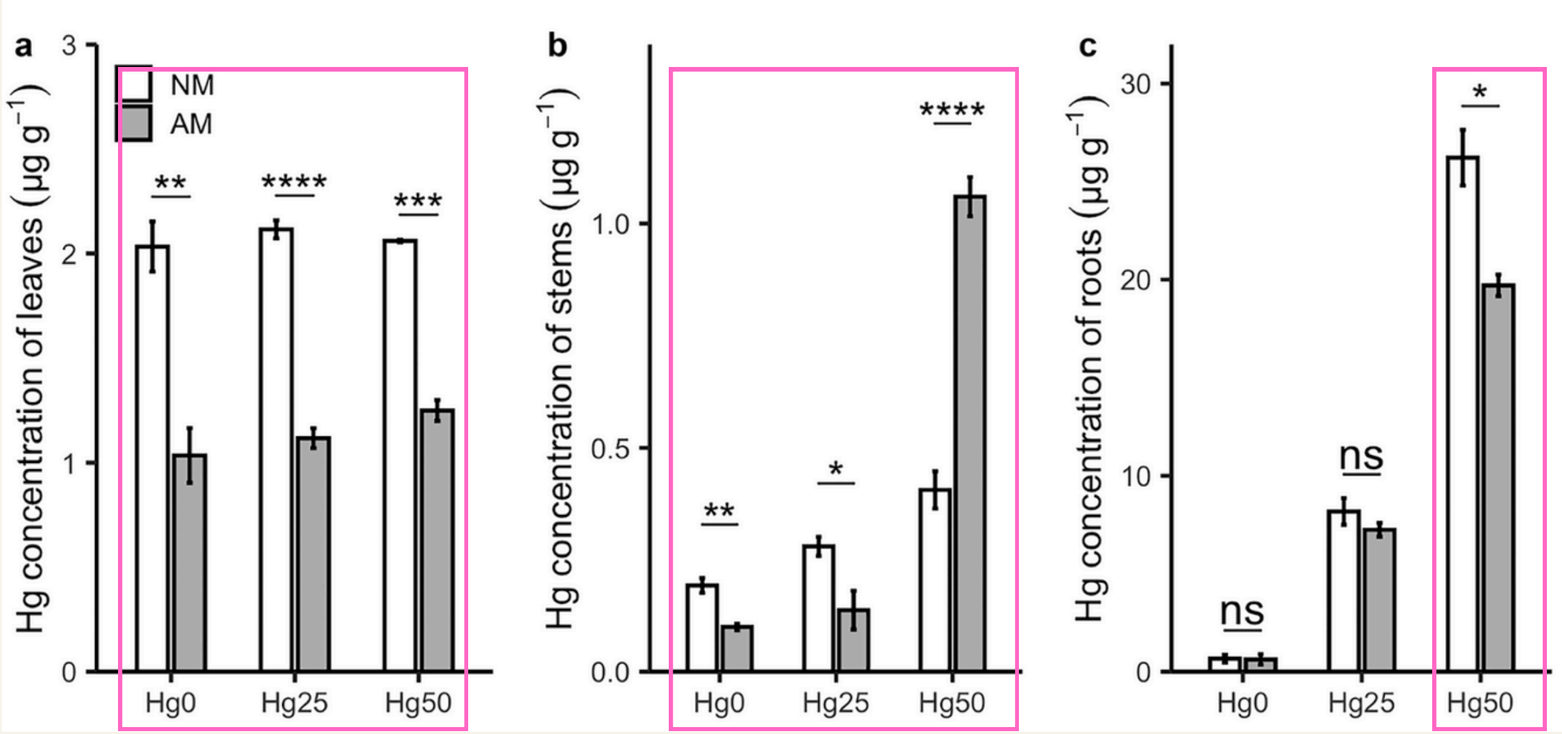
R. irregularis affects Zn and Hg presence in *M. truncatula* under Hg treatment

Statistical info

- Mixed-model ANOVA
- Tukey test
- Non-normal data

	Hg treatment	AM inoculation	Hg treatment x AM inoculation
Mycorrhizal colonization (%)	ns		
Ri α-tubulin expression	ns		
TI	ns	***	ns
Leaf Hg concentration	ns	***	ns
Stem Hg concentration	***	ns	***
Root Hg concentration	***	ns	***
Leaf Hg content	ns	***	ns
Stem Hg content	ns	ns	**
Root Hg content	***	ns	ns
Leaf Zn concentration	ns	**	*
Stem Zn concentration	ns	***	ns
Root Zn concentration	ns	**	ns
Leaf Zn content	ns	ns	ns
Stem Zn content	ns	*	ns
Root Zn content	ns	ns	ns
ZIP2 expression	ns	**	ns
ZIP6 expression	ns	***	ns

R. irregularis affects Hg concentration in different locations within plants



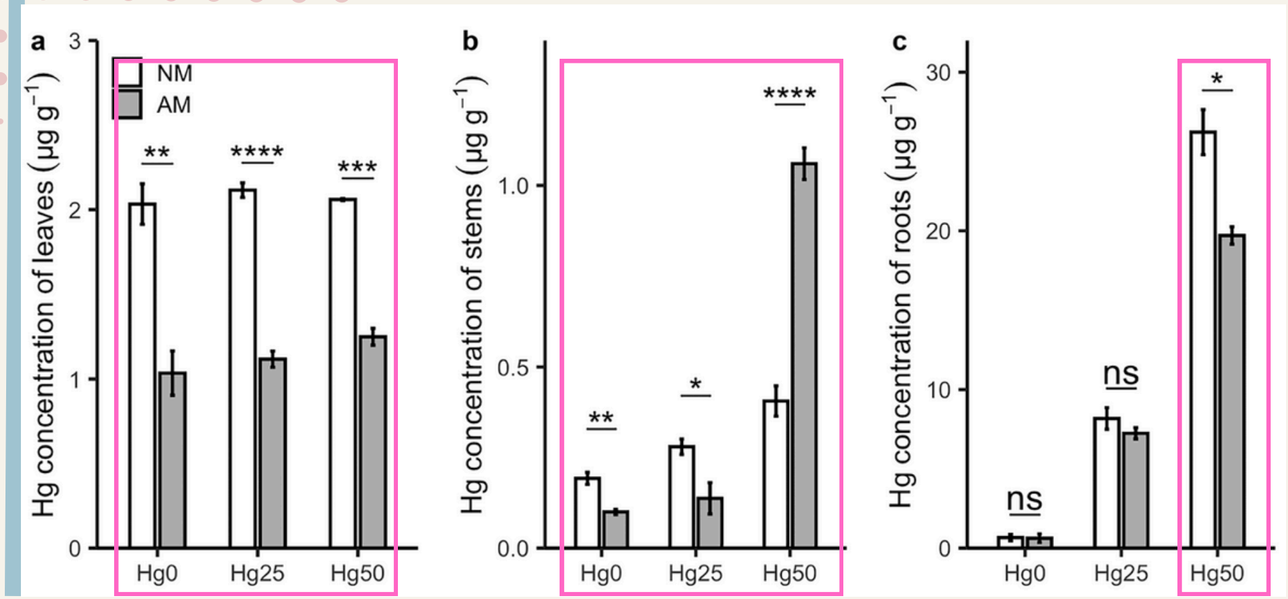
Statistical info

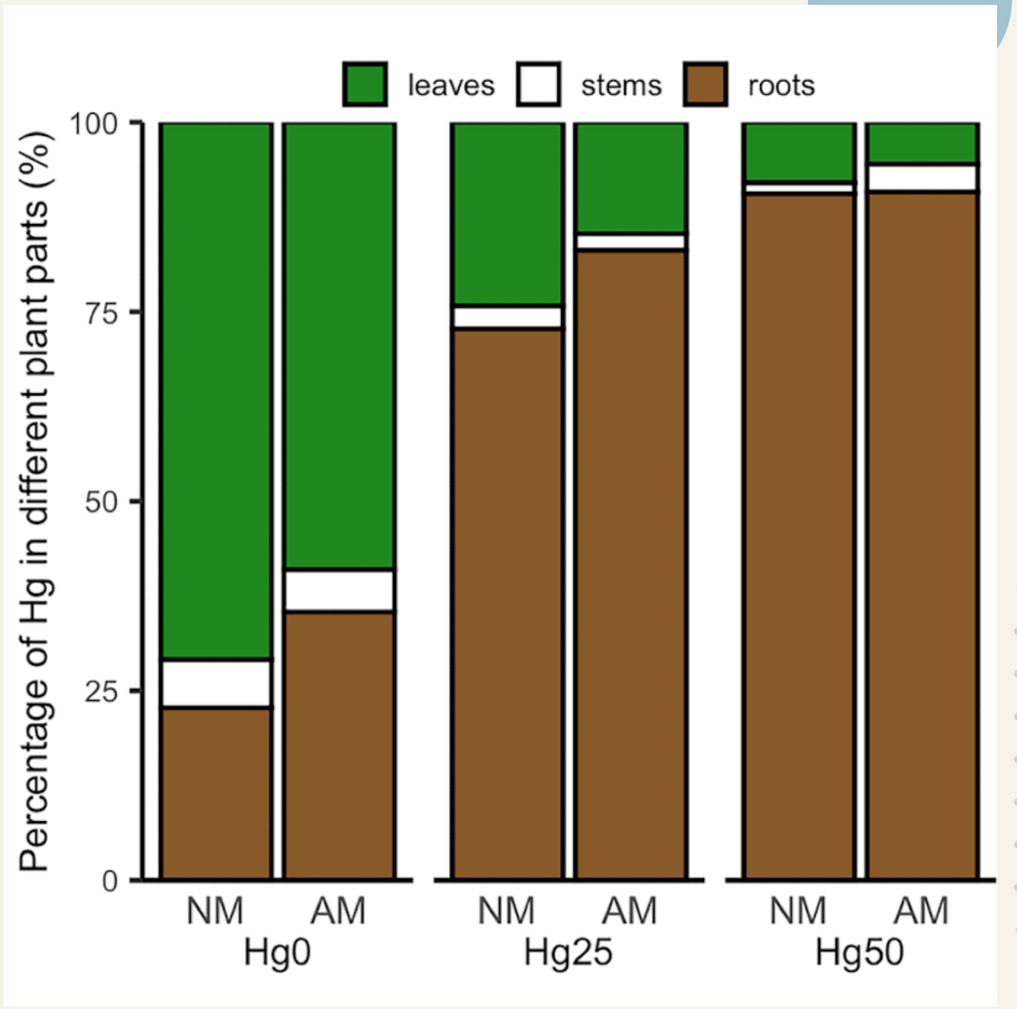
- Mixed-model ANOVA
- Tukey test

Values

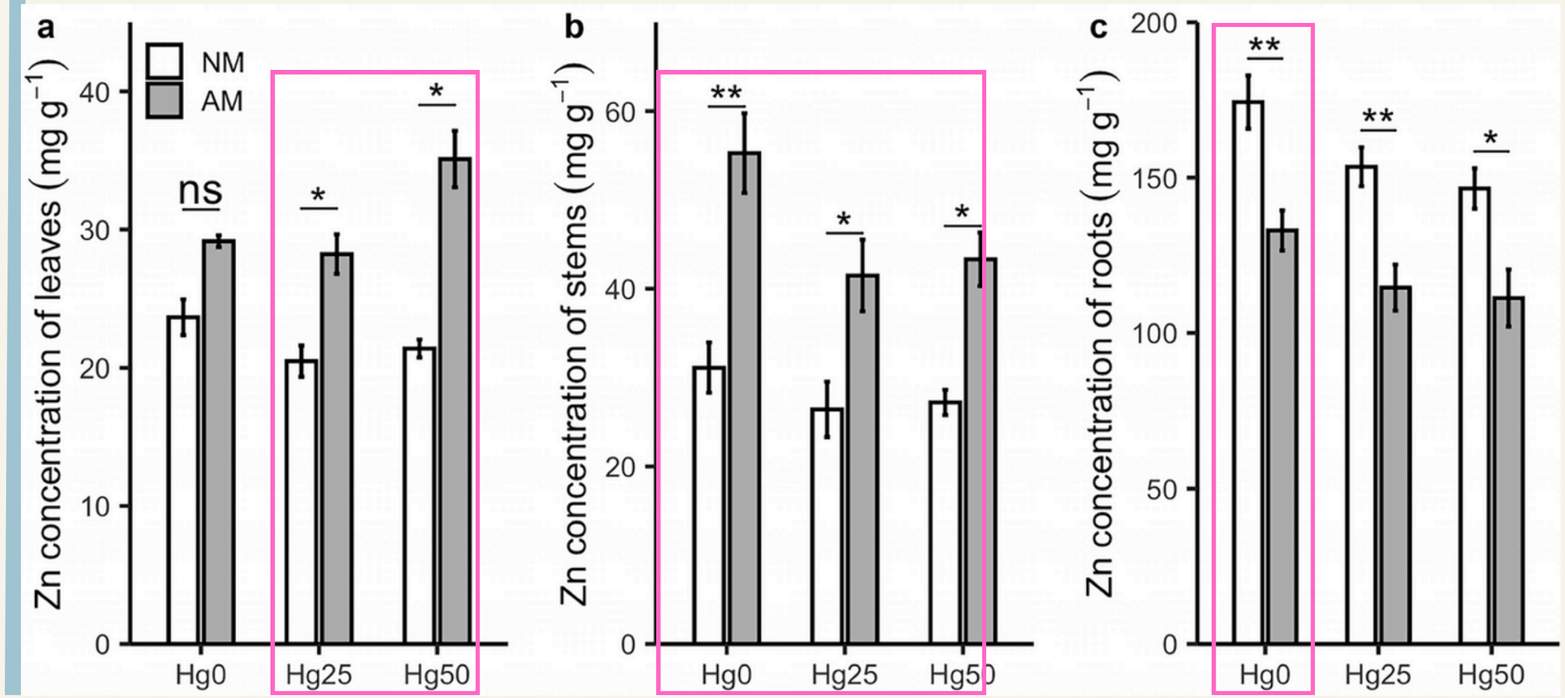
- From $p<0.05$ to 0

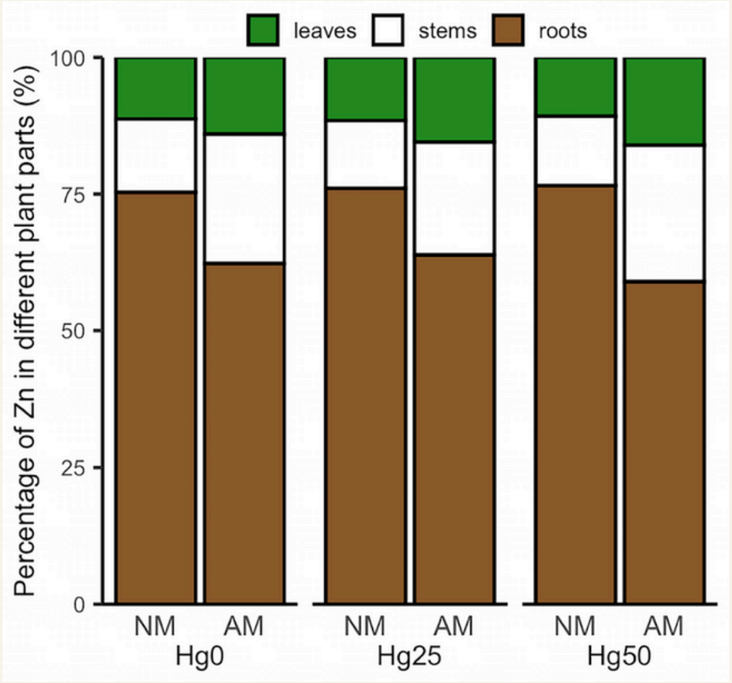
R. irregularis affects Hg concentration in different locations within plants





R. irregularis affects Zn concentration in different locations within plants

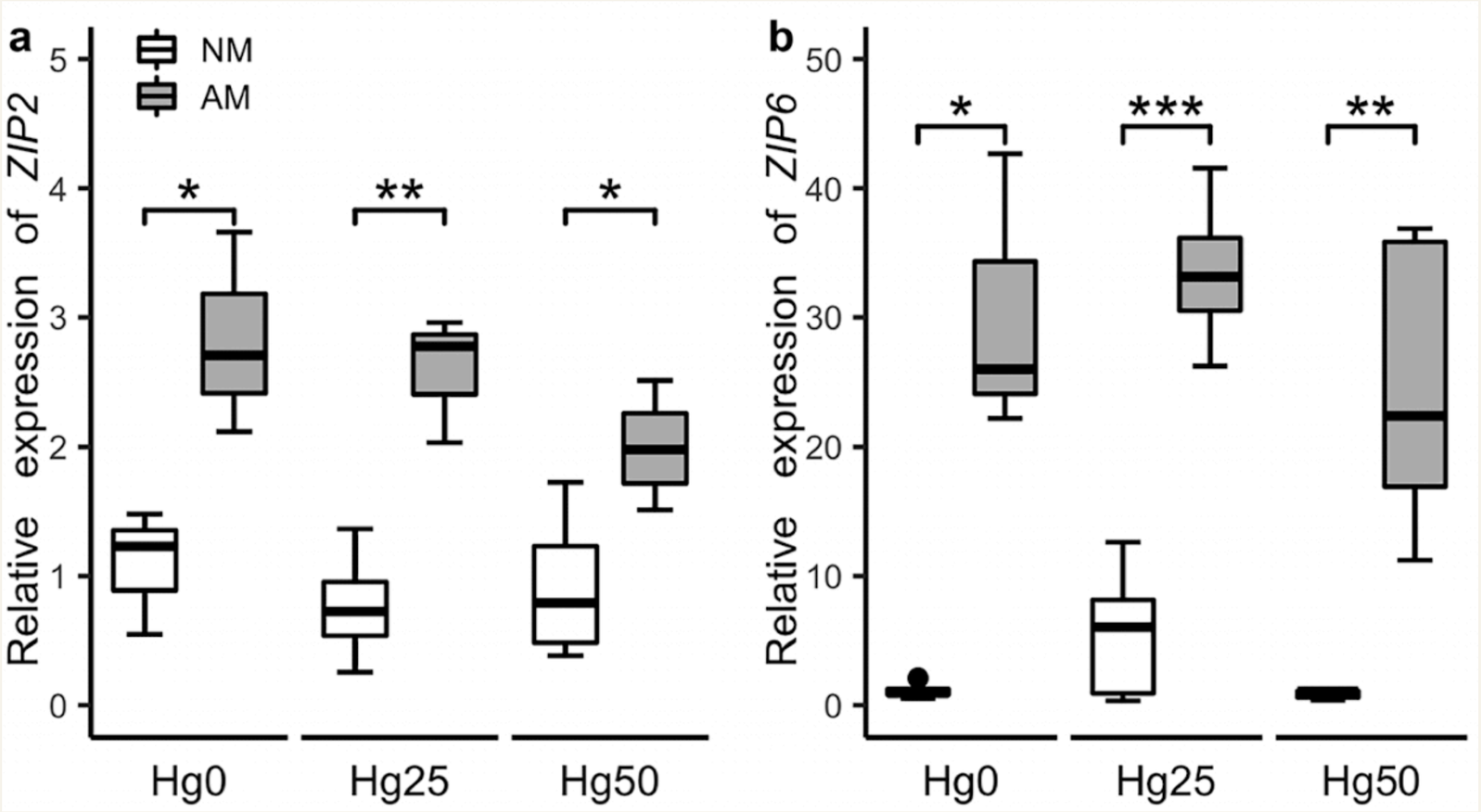




R. irregularis increases Zn transporter expression in *M. truncatula* under Hg treatment

Statistical info

- T-test
- Non-normal data



RESULTS TAKEAWAY

1. ***Rhizophagus irregularis*** **regulates Hg accumulation and translocation in** ***Medicago truncatula*** **under Hg exposure**

2. ***R. irregularis*** **boosts Hg tolerance in** ***M. truncatula***

3. ***R. irregularis*** **enhances Zn status and upregulates Zn transporter genes (ZIP2, ZIP6) in** ***M. truncatula***

AREAS OF IMPROVEMENT

- **Data homegeneity and normality**

  Authors state that non-normal data was Box Cot transformed but data in the presented figures was non-normal

- **Sample size**

  The sample size was ~30, increasing this would lead to more confident results

- **Short term experiment**

  Data collection lasted only 5 weeks, investigating long-term effects may reflect the wild population better

THANK YOU

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