Growth trade-off of fast-growing species grown in Cd perturbed environment

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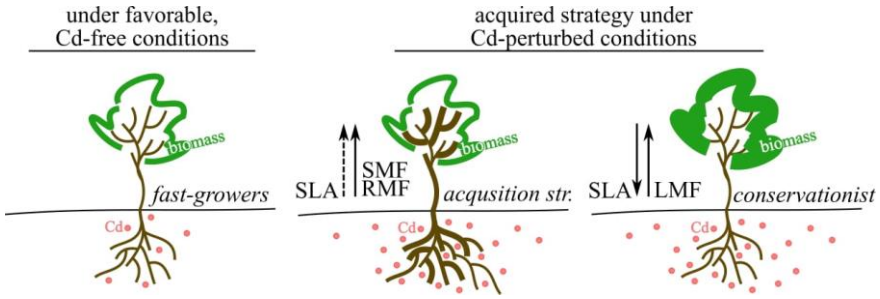
Variations in soil chemical composition may lead to disturbances in plant growth and survival. Which strategies of biomass allocation fast-growing species acquire to overcome the disturbances in the rhizosphere remains an open research challenge. We conducted a series of greenhouse pot experiments to collect enough experimental evidence to elucidate the answer. A tiered analytical approach was applied to collected data to fingerprint both the intra- and interspecies differences.



We investigated the biomass allocation patterns in *Robinia pseudoacacia* L., *Populus* × *euramericana*, *Populus deltoides*, *Salix alba*, *Salix matsudana* Koidz., *Salix viminalis* L. (18 fast-growing genotypes in total) under cadmium-free and cadmium-perturbed soil conditions (Fig. 1).

Evaluated fast-growing genotypes have different strategies under perturbations in soil geochemistry (Fig. 2&3). **Some favors the foliar light-capturing area**, thus foraging for more carbon to over-grow the disturbances at the leaf level (i), while **others invest more carbon into root growth** to preserve the capturing of water and nutrients, and possibly limit the metal uptake (ii).

With the current knowledge and the data presented, we managed to assemble the mechanistic framework on how **the proxy – functional traits** performance modulates the individual fitness of fast growers experiencing the disturbances in the rhizosphere (Fig. 4).

With more effective allocation to the plant organ responsible for the foraging of resources and/or experiencing environmental pressure, plants are able to keep intense growth.

Reference:

Župunski M, Arsenov D, Borišev M, Nikolić N, Pajević S. 2021. Should I GROW or should I SLOW: a meta-analysis of fast-growing tree-species grown in cadmium perturbed environment. Physiologia Plantarum, *In press*. 10.1111/ppl.13594

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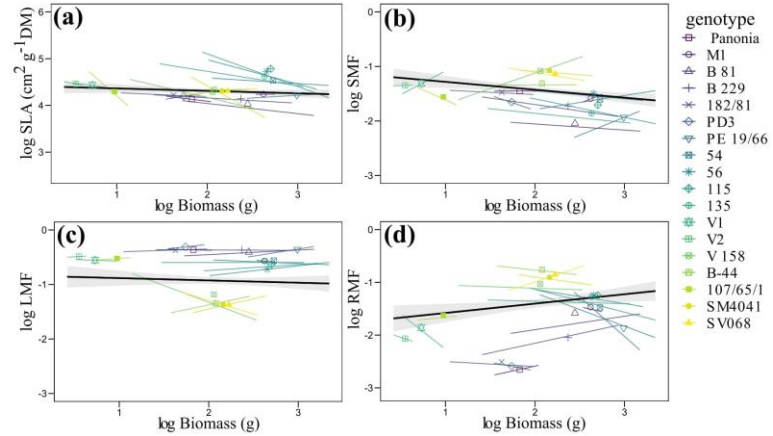

Fig.1 Assessing specific leaf area (SLA) and plant organ weight proportions (leaf mass fraction, LMF; shoot mass fraction, SMF; and root mass fraction, RMF) vs total biomass of 18 fast-growing genotypes.

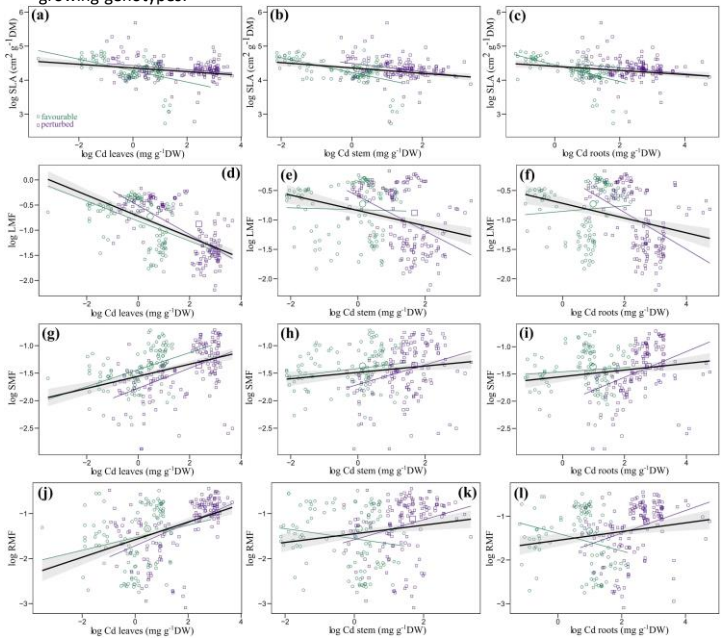

Fig.2 The effect of resource regime Cd tissue concentrations on specific leaf area (SLA) and plant organ weight proportions (leaf mass fraction, LMF; shoot mass fraction, SMF; and root mass fraction, RMF). Note that the axes are on log scale. Green circles denote data points from Cd-free (favorable) resource regime, while purple squares represent Cd perturbed resource regime (group centroid is given with large circle and square, respectively).

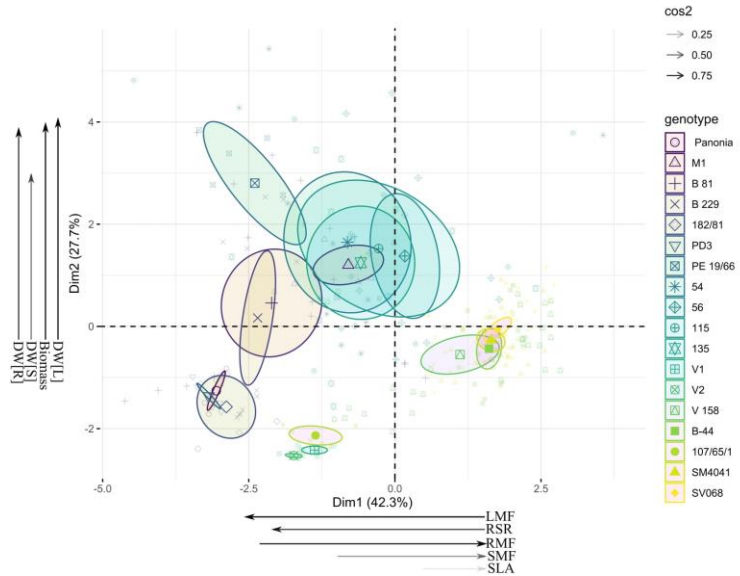

Fig. 3. Clustering of 18 fast-growing genotypes based on output of PCA run over biomass and allometry traits. Contribution of each particular trait to the PC1 and PC2 is given as a vector outside the plot – cos2 value indicate the strength. Ellipses on plot denotes the confidence ellipses around group mean points/centroids (0.95).

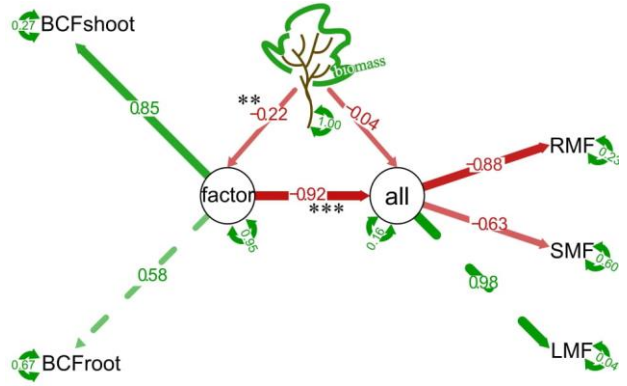

Fig. 4 The schematic of final structural equation model (SEM) discovering the overall effects of Cd bioconcentration indices on total biomass and plant organ weight proportions (LMF, SMF and RMF). Latent variables are given in circles: factor – bioconcentration indices; all – allometry. Number close to the arrows represent the standard path coefficients. Red and green arrows represent positive and negative pathways, respectively. Dashed arrows represent nonsignificant pathways (P< 0.05). Final model statistics: AIC= 2701.798; χ^2= 9018.19, df= 9, *P*= 0.000; RMSEA= 2.017; SRMR= 0.25. Significance: *, P < 0.05; **, P < 0.01; ***, P < 0.001. n = 246.