Interspecies diversity in morphological responses of a panel of crop and weed species to water stress

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Abstract: Climate change is altering the dynamics and amount of water available to plants, and the morphological response of plants to environmental factors plays a key role in crop-weed interactions. Our research focused on interspecies diversity in morphological responses of annual herbaceous species to water stress. Key morphological traits were measured at two growth stages for five weed species and two crop species (soft wheat, rapeseed) grown in a greenhouse under a water availability gradient. For each trait, response curves to water stress were defined and their parameters were used to quantify interspecies diversity. Common patterns of morphological response were identified across species and stages. Water stress led to a reduction in specific leaf area (SLA, reducing water demand) and to an increase in height-to-aboveground biomass ratio (HBR, maintaining light access) in all species. In most cases, the root-to-total biomass ratio (RBR) increased, improving water uptake. Variability in trait responses was primarily driven by species, followed by growth stage. *Geranium dissectum* L. and *Abutilon theophrasti* Medik. were the most responsive species to water stress, particularly at flowering stage, with strong increase in RBR and HBR and slight SLA decrease. Differences between species were not related to clade (monocotyledonous/dicotyledonous) or status (weed/crop), although there was a close-significant effect of clade on aboveground biomass allocation, with monocotyledonous species investing more in stems than leaves. However, dicotyledonous species showed no consistent trends. These results provide new insights into the comparative ecology of crop and weed responses to water limitation, and further research is needed to study more weed and crop species.