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A microRNA regulating targets massively up-regulated in response to stress in drought tolerant A. sagittata

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In plants, photosynthesis is a critical process for survival, and copper is one of the essential micronutrients required for this process. Under abiotic stress conditions such as drought, plants typically reduce photosynthesis to balance their competitive ability with stress tolerance, ensuring survival. This study investigates *Arabis nemorensis* and *Arabis sagittata*, two species growing in competitive meadow environments, focusing on the molecular mechanisms that govern drought tolerance, with special focus on the role of miRNAs. We measured physiological parameters of both species during a dry-down experiment and performed RNA-seq analysis to explore molecular changes in response to drought stress. Our results revealed that both species tolerate extreme drought, wilting below 5% relative water content. However, *A. sagittata* showed a higher survival rate (90%) compared to *A. nemorensis* (49%). Notably, *A. nemorensis* formed larger rosettes that wilted more rapidly under stress. Structural equation modeling indicated that in *A. sagittata*, individuals with lower physiological responses to stress had higher survival rates, a pattern not observed in *A. nemorensis*. Gene expression analysis identified miR408 as a key regulator of drought response in both species. miR408 was upregulated in response to drought, especially in *A. sagittata*, and played a crucial role in modulating the expression of target genes involved in stress tolerance. One of the miR408 targets, AT5G50950 (FUM2), which is involved in the conversion of malate to fumarate in light-dependent reactions, was significantly downregulated during drought in *A. sagittata*. Malate, synthesized by malate dehydrogenase in the chloroplast, may be exported from the chloroplast and converted to fumarate. This study highlights miR408 as a pivotal factor in the drought stress response, with differences in gene expression contributing to the varying levels of drought tolerance observed between *A. sagittata* and *A. nemorensis*. Understanding the regulatory role of miR408 offers new insights into how plant species endure abiotic stress while competing in dense meadow habitats.

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