Dark respiration rates are not determined by differences in mitochondrial capacity, abundance and ultrastructure in C_4 leaves

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Abstract

Our understanding of the regulation of respiration in C_4 plants, where mitochondria play different roles in the different types of C_4 photosynthetic pathway, remains limited. We examined how leaf dark respiration rates (R_{dark}), in the presence and absence of added malate, vary in monocots representing the three classical biochemical types of C_4 photosynthesis (NADP-ME, NAD-ME and PCK) using intact leaves and extracted bundle sheath strands. In particular, we explored to what extent R_{dark} are associated with mitochondrial number, volume and ultrastructure. We found that the respiratory response of NAD-ME and PCK type bundle sheath strands to added malate was associated with differences in mitochondrial number, volume, and/or ultrastructure, while NADP-ME type bundle sheath strands did not respond to malate addition. In general, mitochondrial traits reflected the contributions mitochondria make to photosynthesis in the three C_4 types. However, despite the obvious differences in mitochondrial traits, no clear correlation was observed between these traits and R_{dark}. We suggest that R_{dark} is primarily driven by cellular maintenance demands and not mitochondrial composition *per se*, in a manner that is somewhat independent of mitochondrial organic acid cycling in the light.

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