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The Intercellular Distribution of Glycine Decarboxylase in Leaves of Cassava in Relation to the Photosynthetic Mode and Leaf Anatomy

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Abstract:

There have been conflicting reports on the photosynthetic mode of cassava (*Manihot esculenta* Crantz). It has been suggested that cassava is a C_3 - C_4 intermediate plant and, alternatively, that it is a C_3 plant. Glycine decarboxylase (GDC), a photorespiratory enzyme, is known to exhibit different patterns of intercellular distribution between C_3 - C_4 intermediate and C_3 leaves. In order to elucidate the photosynthetic mode of cassava, we investigated the localization of GDC in the leaves of three cultivars by immunogold electron microscopy and the anatomical structures of the leaves. The leaves of cassava are essentially hypostomatous, and the photosynthetic tissues consist of palisade mesophyll cells (PMCs), spongy mesophyll cells (SMCs) and bundle sheath cells (BSCs). Although the BSCs include centrifugally located chloroplasts, they show no increase in mitochondrial frequency. Labeling specific for GDC was found on all mitochondria of all three types of cell. However, the density of labeling in the PMCs was always higher than in the SMCs and BSCs. In leaves that developed under a water deficit, the difference in labeling density became even clearer. These data suggest that at least the cultivars of cassava examined here are not C_3 - C_4 intermediates and should be regarded as C_3 plants. However, the intercellular differences in the level of accumulation of GDC seem to merit further investigation with respect to an internal gradient of photorespiratory capacity in the leaves.

Keywords:

Cassava, Glycine decarboxylase, Hypostomatous leaf, Immunogold localization, Photorespiration, Photosynthetic mode

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