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L-Ascorbic acid and L-galactose are sources for oxalic acid and calcium oxalate in *Pistia stratiotes*

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Abstract

Axenic *Pistia stratiotes* L. plants were pulse-chase labeled with [14C]oxalic acid, L-[1-14C]ascorbic acid, L-[6-14C]ascorbic acid, D-[1-14C]erythorbic acid, L-[1-14C]galactose, or [1-14C]glycolate. Specific radioactivities of L-ascorbic acid (AsA), free oxalic acid (OxA) and calcium oxalate (CaOx) in labeled plants were compared. Samples of leaf tissue were fixed for microautoradiography and examined by confocal microscopy. Results demonstrate a biosynthetic role for AsA as precursor of OxA and its crystalline deposition product, CaOx, in idioblast cells of *P. stratiotes* and support the recent

discovery of Wheeler, Jones and Smirnoff (Wheeler, G.L., Jones M.A., & Smirnoff, N. (1998). The biosynthetic pathway of vitamin C in higher plants. *Nature*, 393, 365â€“369) that L-galactose is a key intermediate in the conversion of D-glucose to AsA in plants. D-[1-14C]Erythorbic acid (a diastereomeric analog of AsA) is utilized also by *P. stratiotes* as a precursor of OxA and its calcium salt deposition product in idioblasts. Labeled OxA is rapidly incorporated into CaOx in idioblasts, but microautoradiography shows there is also significant incorporation of carbon from OxA into other components of growing cells, contrary to the dogma that OxA is a relatively stable end product of metabolism. Glycolate is a poor substrate for synthesis of OxA and CaOx formation, further establishing AsA as the immediate precursor in the synthesis of OxA used for calcium precipitation in crystal idioblasts.

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Keywords

Pistia stratiotes; Araceae; L-ascorbic acid; Calcium oxalate; Crystal idioblast cells; D-erythorbic acid; L-galactose; Glycolate; Oxalic acid

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