Double hydrogen peroxide treatment induces a chilling tolerance comparable to cold acclimation in mung bean

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ABSTRACT

Mung bean seedlings (Vigna radiata L. cv. TN5, a chilling-sensitive cultivar) pretreated twice with 200 mM hydrogen peroxide (H_2O_2) by a 3-h interval apart followed by chilled at 4oC for 36 h showed a similar electrolyte leakage levels to those of seedlings cold-acclimated at 10oC for 48 h. Double H_2O_2 treated seedlings showed higher glutathione levels than those of control, single-treated, and even cold-acclimated plants. This H_2O_2 induced glutathione accumulation in seedlings did not inference by illumination; however, the glutathione levels of cold-acclimated plants diminished significantly. Seedlings treated with buthionine sulfoximine (BSO), a specific inhibitor of glutathione synthesis, prior to H_2O_2 application reversed the H_2O_2-induced tolerances and thus showed a higher electrolyte leakage. Combination of distinct treatments with ethylene glycol-bis (β -aminothyl ether)-N,N,N´,N´-tetraacetic acid (EGTA), a specific calcium chelator, although had no significantly influence on the glutathione accumulation. However, the tolerances of cold acclimated and H_2O_2 treated seedlings do decrease by EGTA. Notably, ruthenium red, inhibitor of Ca^{2+} flux from intracellular stores, had no obvious influence on both glutathione and electrolyte leakage levels. These observations indicated that extracellular calcium and glutathione accumulation play important roles in the response elicited by H_2O_2 pretreatment in mung bean seedlings. Also, cold acclimation induced chilling tolerance response could separately mediate via both light-dependent and light-independent pathways.

Keywords : hydrogen peroxide (H_2O_2), glutathione, cold acclimation, calcium, chilling tolerance

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