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模拟酸雨对水稻叶片质膜H⁺-ATPase活性与胞内Ca²⁺浓度的影响

Effect of simulated acid rain on plasma membrane H⁺-ATPase activity and intracellular Ca²⁺ concentration in rice leaves

关键词: [胞内Ca²⁺浓度](#) [质膜H⁺-ATPase](#) [模拟酸雨](#) [水稻](#) [胞内H⁺浓度](#)

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摘要: 在水培条件下研究了模拟酸雨 (pH=2.5~5.5) 对水稻叶片胞内Ca²⁺浓度和质膜H⁺-ATPase活性的影响.结果表明: 与对照组 (CK) 相比, 酸雨处理5 d (胁迫期) 后, pH=5.5和5.0处理组的水稻叶片胞内H⁺浓度、质膜H⁺-ATPase活性、胞内Ca²⁺浓度、质膜Ca²⁺-ATPase活性无显著变化; pH=4.0和3.5处理组各指标显著升高, 且H⁺-ATPase活性随Ca²⁺浓度升高而上升; pH=3.0和2.5处理组各指标显著降低, 此时胞内Ca²⁺缺失, 对H⁺-ATPase活性的调节作用受到限制.经正常条件培养5 d (恢复期) 后, pH=4.0和3.5处理组各指标均恢复至CK的处理水平, 表明H⁺-ATPase活性受到Ca²⁺调控已恢复到正常; pH=3.0和2.5处理组的Ca²⁺浓度高于CK及胁迫期, H⁺-ATPase活性低于CK但高于胁迫期, 表明H⁺-ATPase活性受Ca²⁺调控得到部分恢复.因此, 酸雨胁迫下胞内Ca²⁺对质膜H⁺-ATPase活性有一定调节作用, 且受酸雨强度的制约.

Abstract: We studied the effect of acid rain on plasma membrane H⁺-ATPase activity and intracellular Ca²⁺ concentration in rice leaves by hydroponic in a greenhouse. Results show that concentration of intracellular H⁺, activity of H⁺-ATPase, concentration of intracellular Ca²⁺, and activity of Ca²⁺-ATPase in leaves treated with acid rain at pH 5.5 or 5.0 had no significant difference from those of the control ($p < 0.05$). When rice leaves were exposed to acid rain at pH 4.0 or 3.5, these four parameters were all higher than those of the control ($p < 0.05$). In addition, Ca²⁺ concentration increased in response to the increase in activity of H⁺-ATPase by transferring cell signal. When rice leaves were exposed to acid rain at pH 3.0 or 2.5, these four parameters obviously decreased. It was indicated that the intensity of acid rain exceeded the tolerance of rice. Therefore, the regulating effect of Ca²⁺ on activity of ATPase was not obvious. During the recovery period, the four parameters in leaves treated with acid rain at pH 4.0 and 3.5 were close to those of the control, showing that the activity of H⁺-ATPase was recovered because of Ca²⁺ regulation. For pH 3.0 and 2.5 treatments, concentration of Ca²⁺ was higher than that of the control. Activity of H⁺-ATPase was lower than that of the control but higher than that measured during stress period. Results showed that the activity of H⁺-ATPase was partly recovered because of Ca²⁺ regulating. We found that intracellular Ca²⁺ could adjust H⁺-ATPase activity under acid rain stress. Moreover, the regulating effect was related to the intensity of acid rain.

Key words: [intracellular Ca²⁺ concentration](#) [plasma membrane H⁺-ATPase](#) [simulated acid rain](#) [rice](#) [intracellular H⁺ concentration](#)

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