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论文

铝胁迫对花生根尖线粒体膜生理特性的影响

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摘要:

线粒体在植物生命活动中发挥重要作用，以花生为材料，研究了在铝胁迫条件下，花生根尖细胞线粒体膜生理变化。结果表明，通过根长试验、苏木精染色和根尖铝离子含量测定，筛选到耐铝品种LH11，铝敏感品种R1549。铝胁迫后，两个品种根尖线粒体MDA含量增加，R1549的MDA含量均高于LH11，在处理浓度是20 μmol L^{-1}和100 μmol L^{-1}时，两品种的MDA含量差异显著，但在400 μmol L^{-1}时，差异不显著；两品种根尖线粒体Ca^{2+}-ATP酶活性和Ca^{2+}含量呈下降趋势，且随铝溶液浓度增加而加快，R1549的线粒体Ca^{2+}含量下降较LH11快；随处理铝溶液浓度增加，线粒体光密度持续下降，MPT不断增大，$\Delta\Psi_m$明显降低，线粒体中Cyt c/a减少，R1549较LH11下降更明显。试验结果说明在较高铝浓度胁迫下，两品种线粒体透性转换孔开放，膜透性增加，跨线粒体膜Ca^{2+}转运系统活性降低，使胞质Ca^{2+}超载，细胞色素C释放到细胞质中，诱导根尖细胞发生程序性死亡，从而抑制根生长；在低铝浓度下，与铝敏感品种相比，耐铝品种吸收铝少，脂质过氧化水平低，线粒体膜Ca^{2+}-ATPase活性、MPTP和$\Delta\Psi_m$调控能力强，不易发生PCD，从而表现出较强的耐铝能力。

关键词： 铝胁迫 花生 根尖 线粒体 透性生理

Effects of Aluminum on Mitochondrial membrane Physiological Characteristics in Peanut Root Tips

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Abstract:

Mitochondria play a vital role in plant life. Peanut (*Arachis hypogaea* L.) culitivars LH11 (Al-resistant) and R1549 (Al-sensitive) were selected through root elongation experiment, hematoxylin dying and Al^{3+} concentration detection in root tips. The concentration of mitochondrial MDA in two cultivars root tips increased after Al^{3+} treatment that of R1549 was higher than that of LH11. The difference between two cultivars in mitochondrial MDA concentration was very significant in 20$\Delta\Psi$ decreased significantly, mitochondrial Cyt c/a ratio reduced, which was more obvious in R1549 than in LH11 with Al^{3+} concentration increasing. To sum up, high Al^{3+} concentration treatment induced mitochondrial permeability transition pore opening, increased mitochondrial membrane permeability, decreased mitochondrial membrane Ca^{2+} transit system activity so that cytoplasm Ca^{2+} concentration increased, cytochrome c released into the cytoplasm, which might induce PCD(programmed cell death) in root tip, and inhibit root growth. Compared with Al-sensitive cultivar, Al-resistant cultivar has less Al^{3+} absorption and membrane lipid peroxidation level, higher control ability of Ca^{2+}-ATPase activity, MPTP opening and $\Delta\Psi_m$ maintaining so that is not easy to produce PCD under low Al^{3+} concentration stress. It may be one of reasons for Al resistance mechanism in plant.

Keywords: Aluminum stress Peanut(Arachis hypogaea L.) Roottip Mitochondria Permeability physiology

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