Ni^{2+}对槐叶苹叶片生理特征及亚显微结构的影响

中文关键词 Ni^{2+} 槐叶苹 生理 亚显微结构 胁迫

英文关键词 Ni^{2+} *Salvinia natans* physiological submicroscopic stress

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中文摘要

通过10% Hoagland溶液培养试验研究了不同Ni^{2+}浓度(0、5、10、15、20 mg/L)对槐叶苹叶片矿质营养元素吸收、叶绿素含量、可溶性蛋白、保护酶系统、活性氧水平以及细胞亚显微结构的胁迫影响.结果表明，随着Ni^{2+}浓度的增加，①N^{2+}对槐叶苹的矿质营养元素吸收的影响，主要是促进对Ca^{2+}、Na^{+}、Zn^{2+}、Fe^{3+}、Mg^{2+}的吸收，降低对Mn^{2+}、Mo^{2+}、P、K^{+}的吸收.②叶绿素、类胡萝卜素、可溶性蛋白和可溶性糖含量以及超氧化物歧化酶(SOD)、过氧化氢酶(CAT)活性逐渐下降，且20 mg/L 时数值均低于对照.而过氧化氧酶(POD)、超氧阴离子(O^{-}_{2})、过氧化氢(H_2O_2)和丙二醛(MDA)含量逐渐上升，分别为对照的383%、168%、207%和131%.③不连续聚丙烯酰胺凝胶电泳(SDS-PAGE)图谱显示，胁迫导致了相对分子质量(<17200)的多肽增加，并诱导了 94?000 多肽的出现和 35?000 多肽蛋白条带表达量加强.④电镜观察发现，Ni^{2+}胁迫也对叶肉细胞亚显微结构造成了损伤，主要表现为：细胞核核仁解体，染色质凝聚，核膜断裂；叶绿体类囊体膨胀，被膜破裂；线粒体嵴数目减少，线粒体呈空泡状.可见，Ni^{2+}破坏了槐叶苹正常生理活动的结构基础和离子平衡，并造成功能紊乱，这些都是Ni^{2+}对槐叶苹产生胁迫的重要原因.

英文摘要

Influence of 0, 5, 10, 15, 20 mg/L Ni^{2+} on growth, mineral nutrition, chlorophyll, carotenoid, soluble protein, soluble sugar, superoxide (O^{-}_{2}), hydrogen peroxide (H_2O_2) and malondialdehyde (MDA) contents as well as the activities of superoxide dismutase (SOD), guaiacolperoxidase (POD), and catalase (CAT) were studied in the leaves of *Salvinia natans* plants on 10 days after treatment. With the increase of the Ni^{2+} concentrations, exposure of the plants revealed that, ① the addition of Ni^{2+} affected the absorption of mineral nutrients, it mainly increased the absorption of Ca^{2+}, Na^{+}, Zn^{2+}, Fe^{3+} and Mg^{2+}, while reduced that of Mn^{2+}, Mo^{2+}, P and K^{+}. ② The content of chlorophyll, carotenoid, soluble protein and soluble sugar content as well as activities of SOD and CAT decreased gradually. That of O^{-}_{2}, H_2O_2 and MDA content as well as POD activity increased, 383%, 168%, 207%, 131% of these controls, respectively. ③ In the leaves of Ni^{2+}-treated fronds, the polypeptide with apparent molecular weights 94?000 , was became visible in SDS-PAGE, and the nature of it remains to be determined. The amount and intensity of polypeptide band increased gradually with augment of Ni^{2+} was also observed, the polypeptide with apparent molecular weight 35 000 increased significantly in fronds. ④ Transmission electron microscope observation indicated that Ni^{2+} also imposed injury action on submicroscopic structure of leaf cells, disaggregation of nucleolus, agglutination and disappearance of chromatin of nucleus, disruption of nuclear membrane, swelling of thylakoids and breakage of chloroplast envelope, decreasing of cristae quantity and vacuolization of mitochondria. The conclusion could be reached that the plant death was resulted from destruction under structure foundation of physiological function, unbalance of ion equilibrium and disorder of physiological metabolism.