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研究论文

铜胁迫下链格孢菌对白车轴草生理生化特性的影响

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摘要 通过盆栽实验研究了Cu胁迫下接种链格孢菌（Alternaria tenuis Nees）对源自Cu污染区（记作种群Ⅰ）和非污染区（记作种群Ⅱ）白车轴草(Trifolium repens L)生理生化特性的影响。结果表明，两种群白车轴草 在Cu处理后接种链格孢菌，0～1500mg•kg^{-1}时叶片电导率、MDA含量均高于未接种组，且随浓度增加而升高，2000 mg•kg^{-1}时电导率低于未接种组，MDA含量降低但仍高于未接种组。两种群接种后叶绿素、蛋白质含量较未接种组下降，且随Cu浓度增加而降低，其中叶绿素含量与浓度呈显著或极显著负相关，种群Ⅰ和种群Ⅱ相关系数分别为-0.954*和-0.961**。链格孢菌使白车轴草SOD活性低浓度（0和500mg•kg^{-1}）高于未接种组，高浓度则降低。接种后POD活性随Cu浓度增加先增后减，500mg•kg^{-1}浓度下接种组POD高于未接种组，而在其他浓度下，显著低于未接种组。0～1000mg•kg^{-1}时接种组CAT活性高于未接种组，随土壤Cu浓度增加先增后减。3种保护酶对胁迫的敏感性为POD>SOD>CAT。高浓度Cu（2000 mg•kg^{-1}）胁迫下，白车轴草保护酶系统的受损打破了体内活性氧产生与清除之间的正常平衡状态，积累了过量的活性氧，膜脂过氧化程度加重，对白车轴草产生毒害，且这种毒害在接种链格孢菌后表现更为严重。两种群白车轴草相比，种群Ⅰ植物在土壤Cu<2000mg•kg^{-1}时可生存，感染链格孢菌后生长土壤Cu浓度应控制在1500mg•kg^{-1}以内；种群Ⅱ在Cu胁迫浓度不超过1500mg•kg^{-1}，链格孢菌和Cu双重胁迫时不超过1000mg•kg^{-1}可生长。种群Ⅰ在Cu处理、链格孢菌单一或双重胁迫下表现的抗逆性较Ⅱ强。

关键词 白车轴草 链格孢菌 酶活性 Cu

分类号

Effects of Alternaria tenuis Nees on physiological and biochemical characteristics of Trifolium repens L. under Cu stress

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Abstract Through pot cultivation experiments of Trifolium repens L under Cu stress,we studied the effects of Alternaria tenuis Nees on the physiological and biochemical characteristics of two different populations of Trifolium repens L selected from a Cu-polluted area (marked as population Ⅰ) and a non-polluted area (marked as population Ⅱ).The results showed that with Cu treatment, the infection of A. tenuis increased leaves' electric conductivity and MDA content of two populations with Cu concentrations from 0～1500mg•kg^{-1},while electric conductivity was lower and MDA content higher than that of population Ⅱ when Cu concentration was 2000mg•kg^{-1}.The infection also decreased chlorophyll and protein contents. In two inoculated populations, chlorophyll and protein contents declined with the increasing concentration,and chlorophyll content was negatively related to Cu concentration (correlation coefficients of population Ⅰ and Ⅱ were －0.954* and －0.961**).When Cu concentration was low (0 and 500 mg•kg^{-1}),the SOD activity in two populations of inoculated plants was higher than that of non-inoculated plants. But when Cu concentration was high the inoculated plants' SOD activity was lower than that of non-inoculated plants. Similarly, under low levels of Cu (<500mg•kg^{-1}) POD activity was higher of inoculated plants than that of non-inoculated plants. After the increase of Cu concentration POD activity declined rapidly and was lower than that of non-inoculated plants. Finally, CAT in two inoculat

ed populations was higher than in non-inoculated ones from 0～1000mg•kg^{-1},but lower from 1500mg•kg^{-1} in population Ⅰ,whereas in population Ⅱ it was lower at 2000mg•kg^{-1}.The sensibilities of the protective enzyme also differed from each other according to the Cu stress.The order was POD>SOD>CAT. The results also indicated that under the stress of a high Cu level(2000 mg•kg^{-1}), the decline of antioxidative enzyme acitivities broke the normal balance between production and elimination of acitive oxygen, resulting in the accumulation of excessive active oxygen which aggravated lipid peroxidation, therebycausing toxic effects on T. repens.And within the inoculation with A. tenuis,these toxic effects were more serious. Population Ⅰ could subsist within 2000mg•kg^{-1} Cu in soil, but when infected with A. tenuis the concentration should be less than 1500 mg•kg^{-1}.In comparison, population Ⅱ could subsist within 1500mg•kg^{-1} Cu in soil but within 1000 mg•kg^{-1} under the stress of Cu together with A. tenuis.However,compared with population Ⅱ from the non-polluted area,the T. repens in population Ⅰ from the Cu-polluted area showed more resistance to the stress of Cu and A. tenuis.

Key words Trifolium repens L. _ Alternaria tenuis Nees _ enzyme activitie

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