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丛枝菌根真菌(*Glomus caledonium*)对铜污染土壤生物修复机理初探

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Influence of arbuscular mycorrhizal fungus (Glomus caledonium) on maize seedlings grown in copper contaminated soil

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摘要 利用盆栽试验,研究了丛枝菌根真菌(*Glomus.caledonium*)在不同程度铜污染土壤上对玉米苗期生长的影响。结果表明,即使在土壤施铜量达150mg/kg时,菌根真菌对玉米仍有近55%的侵染率;接种菌根真菌,能显著促进玉米根系的生长。菌根玉米的根系生物量和根系长度,平均较未接种处理分别提高108.4%和58.8%;接种处理的植株地上部生物量达到每盆(3株)10.58g,显著高于不施铜的非菌根玉米。这些结果表明,丛枝菌根真菌对铜污染具有较好的抗性;并且由于菌根的形成,使宿主植物明显地改善了对磷的吸收和运输,并能通过抑制土壤酸化、降低土壤可溶态铜的浓度等机制,增强宿主植物对铜污染的抗(耐)性。在150mg/kg施铜水平时,与非菌根玉米相比,菌根玉米地上部和根系铜浓度分别降低24.3%和24.1%,吸铜量分别提高了28.2%和60.0%,表明菌根植物对铜污染土壤具有一定的生物修复作用。

关键词: 生物修复 铜污染 丛枝菌根真菌 玉米 生物修复 铜污染 丛枝菌根真菌 玉米

Abstract: A greenhouse pot experiment was carried out with maize seedlings (*Zea mays* L., cv. nongda 108) grown in a calcareous soil treated with two levels of copper (Cu: 50 and 150 (mg/kg)) and without. Then an arbuscular mycorrhizal fungus (AMF), *Glomus caledonium* was inoculated and the control as set up exactly in the same way except no fungi were inoculated. Mycorrhizal effects were investigated through the comparing of plant growth, Cu uptake and distribution in mycorrhizal and non-mycorrhizal seedlings in order to realize the possible mechanisms of heavy metal resistance of mycorrhizal fungi and application of the fungi in bioremediation of Cu-contaminated soils. The results showed that the fungal infection rate was approximately 55% in the soil supplied with Cu of 150 mg/kg, indicating the high Cu-tolerance of the fungus. At the same time, the biomass and length of the mycorrhizal roots were enhanced by 108.4% and 58.8%, (respectively,) compared with no mycorrhizal fungi. The shoots weight reached 10.58 g/pot in high Cu treatment with (mychorrizal) inoculation, which was significantly higher than the Cu blank control treatment without the fungus. The Cu (tolerance) of mycorrhizal seedlings could be attributed to the improvement of phosphors absorption and translation, soil acidification inhabitation and reduction of soluble Cu content in soil. It is necessary to point out that Cu concentrations in (mycorrhizal) seedlings, compared to non-mycorrhizal plant, was decreased by 24.3% in shoots and 24.1% in roots, which was grown in the soil treated with Cu of 150 mg /kg. However, in contrast to the amounts which were increased by 28.2% in shoots and 60.0% in roots, respectively. At this point, arbuscular mycorrhizal fungus(*Glomus caledonium*) played an important role in the bioremediation of heavy metal contaminated soils.

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