

棉花黄萎病拮抗菌的筛选及其生物防治效果

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Isolation and biological control effects of cotton Verticillium wilt antagonist

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摘要

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摘要 筛选到2株拮抗菌ZJ6和ZJ1并对其进行了鉴定,研究了其在盆栽试验中防治棉花黄萎病的效果,通过PCR的方法扩增了其含有的抗生素合成基因。结果如下:1)根据生理生化特性和16S rDNA序列分析,菌株ZJ6和ZJ1均鉴定为*Bacillus subtilis*。2)拮抗菌ZJ6和ZJ1与复合有机肥(氨基酸肥料:猪粪堆肥=1:1)混合施用(ANT-ZJ6, ANT-ZJ1)以及由ZJ6和ZJ1与复合有机肥二次发酵后制成的生物有机肥(BOF-ZJ6, BOF-ZJ1)对棉花黄萎病均有显著的防治作用,发病率降低39.8%~68.1%,病情指数降低56.3%~82.4%。其中ANT-ZJ6和BOF-ZJ6的防治效果达80%左右。与ANT相比,BOF的防治效果更好,特别是BOF-ZJ1比ANT-ZJ1的防治效果提高了20.8%。3)施用拮抗菌能显著改变根际土的微生物种群结构,施用BOF-ZJ6和BOF-ZJ1后,细菌数量分别增加了7.1和8.5倍,放线菌数量分别增加了11.7和32.6倍,而真菌数量分别下降了53.0%和68.2%,病原菌数量分别下降了98.6%和98.5%。4)ZJ6含有*bam*、*fenB*、*fenD*、*ituA*、*ituB*、*ituC*和*ituD*基因,它们分别是Bacillomycin、Fengycin和Iturin生物合成的相关基因;ZJ1含有*fenB*、*fenD*、*sboA*和*QK*基因,它们分别是Fengycin和Subtilisin生物合成的相关基因。总之,施用含有拮抗菌ZJ6和ZJ1的生物有机肥能有效防治棉花黄萎病。

关键词: 棉花黄萎病 拮抗菌 生物有机肥 微生物区系 抗生素合成基因

Abstract: Cotton Verticillium wilt is a soil-born fungi disease, resulting in severe yield loss of cotton world wide. Compared with the routine control on cotton Verticillium wilt, rhizobacteria-mediated biocontrol is a more effective alternative. Bacteria strains ZJ6 and ZJ1, which were antagonistic to *Verticillium dahliae* Kleb were screened and identified and their effects to control cotton Verticillium wilt were studied in pot experiments. Detection of antibiotic biosynthesis genes of the strains ZJ6 and ZJ1 were also done in this experiment. The results show that: 1) ZJ6 and ZJ1 are both identified as *Bacillus subtilis* according to their physiological and biochemical characteristics and 16S rDNA sequences. 2) The applications of ANT-ZJ6 and ANT-ZJ1 which are simply mixed (ANT-ZJ6 and ANT-ZJ1) or fermented (BOF-ZJ6 and BOF-ZJ1) respectively with organic fertilizers (pig manure compost: amino acid fertilizer=1:1) could control cotton Verticillium wilt effectively. The applications of ANT-ZJ6, ANT-ZJ1, BOF-ZJ6 and BOF-ZJ1 could decrease the incidence of cotton Verticillium wilt by 39.8%-64.1% and disease index by 56.3%-82.4%. The biocontrol efficiency to cotton Verticillium wilt by ANT-ZJ6 and BOF-ZJ6 is about 80%. BOF-ZJ6 or BOF-ZJ1 is more effective in control of cotton Verticillium wilt than that of ZJ6 or ZJ1 respectively. The biocontrol efficiency of BOF-ZJ1 is 20.8% higher than that of ANT-ZJ1. 3) The application of bioorganic fertilizer could change the microbial population of rhizosphere soil. After applications of BOF-ZJ6 and BOF-ZJ1, the populations of bacteria are increased by 7.1 and 8.5 times, actinomyces by 11.7 and 32.6 times, while the populations of fungi are decreased by 53.0% and 68.2%, *Verticillium dahliae* Kleb by 98.6% and 98.5% respectively, compared with those of control. 4) Genes *bam*, *fenB*, *fenD*, *ituA*, *ituB*, *ituC* and *ituD*, responsible for synthesis of antibiotics Bacillomycin, Fengycin and Iturin respectively, are detected in strain ZJ6 while Genes *fenB*, *fenD*, *sboA* and *QK*, responsible for synthesis of antibiotics Fengycin and Subtilisin respectively, are detected in strain ZJ1. It is concluded that the application of bacteria strains ZJ6 and ZJ1 being fermented with organic fertilizers is an effective approach in biocontrol against cotton Verticillium wilt.

Keywords: cotton Verticillium wilt antagonistic bacteria bio-organic fertilizer microorganism flora antibiotic biosynthesis genes

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