

BIOLOGICAL CONTROL OF *Phoma lingam*, THE CAUSAL AGENT OF RAPESEED BLACKLEG BY *Trichoderma* AND *Bacillus subtilis* ISOLATES *

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Abstract

Many isolates of *Trichoderma* spp. and *Bacillus subtilis* are natural biological agents of plant pathogenic fungi and bacteria. *Trichoderma* spp. and *B. subtilis* isolates were separated from the rhizosphere of infected and non-infected rapeseed plants. *Phoma lingam*, the causal agent of rapeseed black leg, was isolated from different tissues of infected plants, and infested soil. Dual cultures were used to examine the antagonistic effects of *Trichoderma* and *B. subtilis* isolates on *P. lingam*. In the greenhouse, the antagonistic effects of the isolates were tested through treating rapeseed seeds and rapeseed above-ground parts with the isolates. Totally, 20 isolates of *P. lingam*, 15 isolates of *Trichoderma* species and 17 isolates of *B. subtilis* were separated. Bacterial isolates BE3, B31, B66, B67, B68, B69, and B70, and *Trichoderma* isolates Tr.2901, Tr.2903, Tr.2904, Tr.2910, and Tr.2913 showed antagonistic effects on the pathogen. The greenhouse results revealed that in the seed treatment experiment, the bacterial isolates B70 and B67, and *Trichoderma* isolates Tr.2910 and Tr.2901 decreased the rapeseed blackleg to 43.3, 80, 16.6 and 56.6%, respectively. Treating the above-ground parts with bacterial isolates did not reduce rapeseed blackleg at all. Treating above-ground parts by Tr.2910 and Tr.2901 isolates of *Trichoderma* decreased the disease to 60 and 79.6%, respectively. *Trichoderma* isolates belonged to several species where the differentiation of the isolates from species was impossible based on the morphological characteristics. The two effective bacterial isolates were related to *B. subtilis*.

Keywords: Antagonistic effects, Antagonistic agents, Rhizosphere, Seed treatment, Foliage treatment

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