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# INDUCED SYSTEMIC RESISTANCE OF SELECTED ENDOPHYTIC BACTERIA AGAINST MELOIDOGYNE INCOGNITA ON TOMATO

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## SUMMARY

Four endophytic bacteria *Pantoea agglomerans* MK-29, *Cedeca davisae* Enterobacter spp. MK-42 and *Pseudomonas putida* MT-19 were shown to reduce *Meloidogyne incognita* on tomato when applied as a seed treatment and/or soil drench. The objective of this work was to study these bacteria for their potential to induce systemic resistance against root-knot nematodes on tomato. To guarantee spatial separation between inducer and pathogen a split-root system was chosen and inoculated with the bacteria as a seed treatment on one side of the root system and 6 days later with 2000 juveniles of *Meloidogyne incognita* on the other side of the split-root system. The experiment was maintained in the greenhouse and repeated once. The penetration rate of juveniles as well as the number of root-knot galls and egg masses was recorded. Treatment with all four bacteria significantly reduced juvenile penetration and the number of root-knot galls when compared to the non-treated control. Induced systemic resistance is considered a possible control mechanism of endophytic bacteria against root-knot nematodes.

## INTRODUCTION

Endophytic bacteria are ubiquitous to most plant species, and internal colonizers of the plant that do not harm the plant (Hallmann *et al.*, 1997a). Some of these endophytic bacteria are beneficial to the plant, i.e. they stimulate plant growth and health. Once inside the plant, endophytic bacteria can colonize potential infection sites of plant pathogens. The plant environment also protects the endophytes against environmental stresses. For these reasons, there is considerable interest in endophytic bacteria as biocontrol agents especially those providing economical features such as plant growth promotion and stimulation of plant defence mechanisms (Hallmann, 2001). Previous reports have shown that bacterial endophytes reduce disease symptoms caused by plant pathogens such as *Fusarium* sp. *vasinfectum* on cotton (Chen *et al.*, 1995), *Rhizoctonia* on potato and cotton (Pleban *et al.*, 1995) and *Meloidogyne incognita* on tomato and cucumber (Hallmann *et al.*, 1997b; Munif *et al.*, 2000).

The mechanisms of how endophytic bacteria stimulate plant growth and health are poorly studied, but might be similar to those described for plant growth-promoting rhizobacteria (Höflich *et al.*, 1994; Kloepper *et al.*, 1991). Potential mechanisms include: 1) direct antagonism, 2) niche exclusion, 3)

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1. (1995) and Martinez-Ochoa *et al.* (1995) for *Globodera pallida* and *M. incognita*, respectively.

In the present study, the endophytic bacteria *P. agglomerans* MK-29, *C. roseae* MK-30, *Enterobacter* spp. MK-42 and *P. putida* MT-19, that previously demonstrated biocontrol potential against *M. incognita*, were tested as a potential mode-of-action. The application of the endophytic bacteria to one side of the split-root system resulted in a significant reduction of juvenile penetration as well as number of galls and egg masses on the other side of the split-root system. These results strongly indicate ISR as a control mechanism and characterize these bacteria as plant health-promoting rhizobacteria (Sikora, 1988).

It was demonstrated, the origin of the inducing agent is still general, ISR can be caused by microbial metabolites and/or constituents. Hasky-Günther *et al.* (1998) and Reitz *et al.* (1998) studying the inducing agent of the rhizobacteria *Rhizobium etli* G12 and *Bacillus sphaericus* B43 causing ISR in potato towards the potato cyst nematode *G. pallida*, found that both viable and heat-killed cells of *R. etli* G12 and *B. sphaericus* B43 significantly reduced nematode penetration. Only the culture filtrates of *B. sphaericus* B43 and not of *R. etli* G12 induced systemic resistance indicating different modes-of-action. For *R. etli* G12 it was shown that purified bacterial lipopolysaccharides (LPS) and not exopolysaccharides (EPS) acted as the inducer of the plant defense response. Similar LPS extracted from the outer membrane of *Pseudomonas fluorescens* strain WCS417r induced resistance in carnations against *Fusarium wilt* (van Peer *et al.*, 1991). Bacterial LPS are known to bind to plant cell walls (Costeron *et al.*, 1987), thus enabling signal transmission between the bacterium and the plant. If LPS plays a key role in bacteria-mediated induced resistance, endophytic colonization of the bacterium could improve signal transmission between the bacterium and the plant thus leading to a longer and more persistent ISR response.

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