

Colonization of endophyte *Pantoea agglomerans* YS19 on host rice, with formation of multicellular symplasmata

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Abstract *Pantoea agglomerans* YS19 is a diazotrophic endophyte isolated from rice (*Oryza sativa* cv. Yuefu) grown in a temperate-climatic region in west Beijing (China). The colonization of YS19 on host rice was studied in this paper. It was revealed that YS19 colonizes in all the tissues of rice seedlings, including roots (dominantly at elongation regions, lateral root junctions, root hairs and root caps), stems and leaves. More YS19 colonizes in stem and leaves (1.40×10^5 CFU mg⁻¹ fresh weight) than that in roots (3.60×10^4 CFU mg⁻¹). Symplasmata, a kind of adaptive structure of the strain for its endophytic living, were repeatedly observed to form inside root or stem cortex parenchyma tissues, as well as on leaf surfaces and also rhizoplanes. A novel matrix protein (SPM43.1) with its expression paralleling to the formation of symplasmata was captured, whose meaning in structural construction of symplasmata was also discussed.

Keywords Rice · *Pantoea agglomerans* · Endophyte · Colonization

Introduction

Many endophytes are characterized by promoting beneficial effects on plant growth through nitrogen fixation, phytohormone production and disease control (Kloepper

et al. 1992; Lee et al. 2000). Endophytes can be helpful to reduce the application of agri-chemicals, maintain the biotic diversity in the plant-associated bio-community and provide natural methods of crop growing in expectation of moving toward agricultural and environmental sustainable development (Sturz et al. 2000).

Endophytic bacterium *Pantoea agglomerans* YS19 was isolated as a dominant strain from a widely planted rice (*Oryza sativa*) cultivar Yuefu in a temperate-climate region in west Beijing, China (Yang et al. 1999; Feng et al. 2003). YS19 was isolated most frequently and in large numbers from all the surface disinfected plant tissues (root, stem, leaf, and seed) sampled at different growth and development stages (Yang et al. 1999). Moreover, YS19 showed higher nitrogen-fixing activity than other endophytic bacteria isolated from this plant on the basis of acetylene reduction activity and ¹⁵N₂-fixing activity, indicating it being a diazotrophic endophyte (Yang et al. 1999). Strikingly, strain YS19 was verified to promote host plant growth and affect allocation of host photosynthates (Feng et al. 2006b). In vitro study had revealed that there are two growth stages in medium for this strain, including the single cell stage existing before the end of the exponential growth phase and the symplasmata formation stage starting from then on (Feng et al. 2003). This paper attempted to elucidate the colonization of YS19 on the host rice, especially, its symplasmata formation *in planta*.

Materials and methods

Bacterial strains and growth conditions

P. agglomerans YS19 was isolated in our lab as a diazotrophic endophyte from rice (*O. sativa* cv. Yuefu).

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