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ABSTRACT OF DOCTORAL THESIS

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Title: Bacterial–fungal interactions between *Paraburkholderia fungorum* GIB024 isolated from a *Rhizopogon roseolus* sporocarp and ectomycorrhizal fungi: Mycelial growth-promoting activity and fungal strain specificity
(ショウロ子実体から分離した*Paraburkholderia fungorum* GIB024細菌と外生菌根菌との相互作用：菌糸生育促進活性ときのこ菌株系統特異性)

Rhizopogon roseolus ("shouro" in Japanese) is an edible ectomycorrhizal (ECM) mushroom with high economic value. Previous study found that a sporocarp (fruiting body) of *R. roseolus* in a *Pinus thunbergii* (Japanese black pine) dominance forest harbored unique community of bacteria that might be committed in mutual bacterial-fungal interaction (BFI) toward its fungal host. One of the bacteria, *Paraburkholderia fungorum* strain GIB024, showed a mutual BFI by its ability to promote mycelial growth of *R. roseolus* trough in-vitro direct confrontation screening. However, the mycelial promoting mechanism of this bacterium was not revealed yet. Moreover, the literature studies showed that this bacterium was wide pervasive and co-occurance with various fungal host. In mutual BFI, the bacterium relies on fungal carbonaceous compounds as source of nutrients while extracellularly release mycelial growth-promotor, in the form of volatile or soluble compound. Therefore, the aim of this current study was to investigate the potential role of the extracellular mycelial growth-promoting metabolite, identified the possible fungal carbonaceous compounds during mutual BFI of *P. fungorum* – *R. roseolus* and specificity interaction of the bacterium with other ECM mushrooms. The study have been done through three consecutive experiments: (1) investigating mycelial growth-promoting potential of extracellular metabolites of *Paraburkholderia* spp. isolated from *R. roseolus* sporocarp, (2) investigating the potential role of the fungal carbonaceous compounds in the mycelial growth promotion of *R. roseolus* during interaction with the sporocarp bacterium, *P. fungorum* GIB024, (3) investigating the specificity promotion of *P. fungorum* GIB024 toward mycelium growth of other ectomycorrhizal fungi. The results showed that through chemical interaction, *P. fungorum* GIB024 excreted soluble metabolite(s), instead volatile metabolite(s), that are able to promote the mycelial growth of *R. roseolus*. There is a possible metabolite exchange mechanism between *P. fungorum* – *R. roseolus*. Fungal exudates, in the form of organic acids, were utilized by the bacterium to promote its growth, as an exchange, the bacterium synthesized mycelial growth-promoting metabolite(s). The ability of *P. fungorum* GIB024 to utilize organic acids, particularly oxalic acid, is an indication the involvement of this bacterium in biogeochemical cycle, in this case carbon cycle, through oxalate-carbonate pathway (OCP). Regarding the mutual interaction and mycelial growth-promoting ability with other ectomycorrhizal fungi, *P. fungorum* GIB024 showed nutrient-, species-, and plant host- dependent. *P. fungorum* GIB024, isolated from *R. rosoelus* sporocarp in *P. thunbergii* forest, is a specific fungiphile bacterium, as its mycelial growth-promoting ability was narrowed to ectomycorrhizal fungi associated with *P. thunbergii* only, namely *R. roseolus*, in rich nutrient, and *S. bovinus*, in poor nutrient. The information of this research will contribute to deepen understanding BFI in mushroom science and to promote application study in which GIB024 was effectively used in production of ectomycorrhizal pine trees and cultivation of shouro mushroom.