2-O08-1

Root endophytic *Chaetomium cupreum* increased Al tolerance in *Miscanthus sinensis* growing at an old mine site

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Purpose: Aluminum (Al) causes plant toxicity in acid soil such as mine sites. *Miscanthus sinensis* has Al tolerance via producing chlorogenic, citric, and malic acids to detoxify Al. Some root endophytes produce siderophores, which detoxify Al by chelating. *Chaetomium cupreum* isolated from roots of *M. sinensis* growing at a mine site showed high siderophore production. The purpose of this study was to clarify Al-tolerance mechanisms in *M. sinensis* by considering the interaction with *C. cupreum*.
Methods: The siderophore was identified as oosporein by HPLC/ESI-HDMS and XRD. The stability constant of oosporein-Al was calculated to evaluate Al-detoxification efficiency via titration. *Chaetomium cupreum* was used for soil-inoculation test with *M. sinensis* to clarify chemical Al tolerance via measuring concentrations of Al by ICP-OES, chlorogenic acid, and oosporein by HPLC/MS. In water-inoculation test, Al localization was observed by confocal laser microscopy to clarify physical Al tolerance.
Results: The stability constant of Al and oosporein was lower than chlorogenic acid, and higher than citric and malic acids. In soil-inoculation test, *C. cupreum* enhanced plant growth, seemed to increase chlorogenic acid production, and produced oosporein in the roots. Al was localized in cell walls of roots. *Chaetomium cupreum* changed Al localization in roots, and accumulated Al in the hyphae to decrease Al toxicity to *M. sinensis*.
Conclusions: Oosporein could detoxify Al more efficiently than citric and malic acids. *Chaetomium cupreum* enhanced Al tolerance in *M. sinensis* via increasing detoxified Al concentration by chlorogenic acid and oosporein, changing Al localization, and accumulating Al in the hyphae.