ABSTRACTS (MASTER THESIS)

Secretion of tomatine from tomato roots and analysis of tomatine in the field

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It is known that plants secrete various secondary metabolites from roots, and these metabolites are involved in the interaction between plants and microorganisms in the rhizosphere. Rhizosphere microbiota play an important role in plant growth and health. To archive sustainable agriculture with reduced fertilizers and pesticides, it is important to deepen our understanding of the interactions between plants and microorganisms and control of rhizosphere environment through root exudates. Tomato is one of the most cultivated vegetable in the world. Tomato biosynthesizes the glycoalkaloid α-tomatine and accumulates it in each organ of the plant. Tomatine is toxic to a wide range of organisms including insects and fungi, and has a function to protect plants from various biological stresses. Although tomatine is recently shown to be secreted into the rhizosphere, the function of tomatine in the tomato rhizosphere and the mechanism of secretion from the roots are still unknown. The purpose of this study was to clarify the secretion of tomatine using hydroponic and field-grown tomatoes in order to elucidate the function of tomatine in the rhizosphere.

Tomato (*Solanum lycopersicum*) was grown in hydroponic culture, and tomatine contents in leaves, roots, and root exudates was quantified using LC-MS at 2 week intervals from 3 weeks to 13 weeks after sowing. Tomato was also grown in the field, and tomatine in plant and rhizosphere soil was quantified, and rhizosphere microbiota was analyzed.

In hydroponically grown tomatoes, the amount of tomatine was highest at 7 weeks, which is the flowering stage, and was hardly secreted after fruit setting. Tomatine content was higher in the leaves than in the roots throughout the growing periods. The roots of young plants accumulate a large amount of tomatine, which may protect roots from potential pathogens. Field-cultivated tomatoes also secreted tomatine throughout the growth period. The content of tomatine in roots was higher in the field cultivation than in hydroponic cultivation. In the field, it was considered that tomatine biosynthesis may be activated in the roots for the protection from pathogenic bacteria and fungi. To analyze the expression of genes involved in tomatine biosynthesis in leaves and roots, RNA was extracted and reverse-transcription quantitative PCR was performed. We also analyzed the tomato rhizosphere microbiota in order to investigate the effects of tomatine secretion on rhizosphere microorganisms.