
ABSTRACTS (MASTER THESIS)

**Biochemical analysis of coumarin-specific prenyltransferase activities in lemon peel
(Graduate School of Agriculture,
Laboratory of Plant Gene Expression, RISH, Kyoto University)**

Ryosuke Munakata

Coumarins (α -benzopyrones) form a large group of plant polyphenols, and thus far about 1,500 coumarin derivatives have been isolated from plants. Coumarins occur ubiquitously in the plant kingdom, and coumarin derivatives exhibit a variety of biological functions such as chemoprevention against pathogens, herbivores, and abiotic stresses, implying physiological roles of coumarins for plants in the adaption to environmental stresses. Besides, some coumarin derivatives are also known to act beneficially on human health due to their therapeutic effects, e. g., inhibitory activities against various tumor cells and mycobacteria, which have been extensively studied in the medical and pharmaceutical fields for the treatments of human disorders.

In plant cells, almost coumarin molecules undergo some modifications, i. e., glycosylation, prenylation, hydroxylation, methylation, and prenylation. Prenylation contributes to the enhancement of biological activities of coumarins. As for prenyltransferases of coumarins, umbelliferone 6-dimethylallyltransferase activity and umbelliferone 7-*O*-dimethylallyltransferase activity were reported in *Ruta graveolens*, and *Ammi majus*, respectively. However, there is no report on coumarin-prenyltransferase activities in citrus species, regardless of their importance in basic and applied sciences. We employed lemon (*Citrus limon*) as a resource for the study on prenyltransferase specific for coumarins because a large amount of prenylated coumarins are accumulated in peels. Plant-derived prenyltransferases for aromatic metabolites have been studied for more than four decades.

We have detected both *O*- and *C*-prenyltransferase activities for coumarin substrates in the microsome fraction prepared from lemon peel (Munakata et al., 2012). Bergaptol was the most preferred substrate out of various coumarin derivatives tested whereas geranyl diphosphate (GPP) was exclusively accepted as prenyl donor substrate. Further enzymatic characterization of bergaptol 5-*O*-geranyltransferase activity revealed some unique properties. Our findings provide valuable information for the discovery of a yet unidentified coumarin-specific prenyltransferase gene.

References

- [1] Munakata, R., Inoue, T., Koeduka, T., Sasaki, K., Tsurumaru, Y., Sugiyama, A., Uto, Y., Hori, H., Azuma, J., Yazaki, K., "Characterization of coumarin-specific prenyltransferase activities in *Citrus limon* peel", *Biosci. Biotech. Biochem.* 76(7), 1389-1393, 2012.