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学 位 論 文 審 査 の 要 旨

博士の専攻分野の名称　博　士（農学）　　氏名　荒　川　　竜　太

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学 位 論 文 題 名

Characterization of maize genotypes that differ in biological interactions with parasitic and symbiotic organisms with respect to strigolactones
（トウモロコシにおける寄生および共生生物相互作用とストリゴラクトン分泌特性との関係）

This thesis consists of 16 figures, 9 tables, 96 references, General introduction, two Chapters, and General discussion in a total of 75 pages with two accompanying publications.

Arbuscular mycorrhizal (AM) fungi associate with most land plants and supply phosphate to the host. Strigolactones, a group of sesquiterpene lactones, are exuded from plant roots in response to nutrient deficiency to attract AM fungi, but the compounds also stimulate seed germination of parasitic plants such as *Striga* and *Orobanche* spp. Susceptibility to the parasitic plants and compatibility to AM fungi are variable among plant genotypes/species. In addition, under natural conditions AM fungal show ecological host specificity/preference. Generally, plants exude structurally diverse strigolactones, leading to the hypothesis that strigolactones play a significant role in these interactions with the parasitic and symbiotic organisms.

1. Involvement of strigolactone stability interactions with *Striga* spp. and arbuscular mycorrhizal fungi

Strigolactones in root exudates of Striga-susceptible (Pioneer 3253) and -resistant (KST 94) cultivars were characterized by LC–MS/MS combined with germination assay using Striga hermonthica seeds. Levels of colonization and community compositions of AM fungi in the two cultivars were investigated in field and

glasshouse experiments. 5-Deoxystrigol was exuded exclusively by the susceptible cultivar, while the resistant cultivar mainly exuded sorgomol. Despite the distinctive difference in strigolactone composition, the levels of AM colonization and the community compositions were not different between the cultivars. The present study demonstrated that the difference in strigolactone composition has no appreciable impact on AM symbiosis, at least in the two maize cultivars, and further suggest that the traits involve in Striga-resistance is not necessarily accompanied by reduction in compatibility to AM fungi.

2. Involvement of compatibility to arbuscular mycorrhizal fungi in phosphorus acquisition strategy with respect to strigolactones

Three maize genotypes that are highly compatible to AM fungi and three low-compatible genotypes were grown in the presence and absence of AM fungi in a glasshouse to investigate whether compatibility to the fungi is relevant to responsiveness to the fungi. The six genotypes were also grown in hydroponic culture for strigolactone analysis by *Orobanche minor*-seed germination test after fractionation by HPLC as well as in the field for AM fungal community analysis. In terms of phosphorus uptake, the responses of the genotypes to mycorrhizal formation were not correlated with their compatibility to AM fungi, implying that highly (low)-compatible genotypes did not necessarily show greater (lower) dependency to AM fungi. *O. minor*-seed germination activity in the root exudates, however, was significantly higher in several fractions of the exudates form the highly-compatible genotypes, although the community compositions of the fungi were not different between the highly-compatible and low-compatible genotypes. These results suggest that difference in compatibility to AM fungi is highly likely to be a reflection of quantitative and/or qualitative differences in strigolactone exudation, but not that of dependency to the fungi.

In contrast to the specific responses the parasitic plants to structurally different strigolactones, responsiveness to diverse strigolactones has not differentiated among AM fungal species, which might have maintained their broad host ranges during the long history of coevolution with land plants.

Therefore, we acknowledge that the author is qualified to be granted the Degree of Doctor of Philosophy in Agriculture from Hokkaido University.