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学 位 論 文 内 容 の 要 旨

博士の専攻分野の名称　博　士（農学）　　氏名　荒川　竜太

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）

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 via promoting hyphal branching, but the compounds also stimulate seed germination of parasitic plants such as *Striga* and *Orobanche* spp. Susceptibility to the parasitic plants, as well as compatibility to AM fungi, are variable among plant genotypes/species. In addition, under natural conditions AM fungi show ecological host specificity/preference, that is, different plant species associate with different AM fungal assemblages. Generally, plants exude structurally diverse strigolactones, but ecological relevance of the diversity to the interactions with the parasitic and symbiotic organisms has yet to be elucidated.

1. Strigolactone stability correlates with susceptibility to *Striga* spp., but not with colonization of arbuscular mycorrhizal fungi

In this chapter, the hypotheses that qualitative and quantitative differences in strigolactone exudation would determine i) susceptibility to the parasites, ii) compatibility to AM fungi, and also iii) community composition of the fungi via promoting colonization of differ fungi are addressed. Two maize genotypes that differ in susceptibility to *Striga* spp. were grown in hydroponic culture, and strigolactones exuded into the media were collected and characterized by LC-MS/MS. The two genotypes were grown in the presence of natural AM fungal community under field and glasshouse conditions, and DNA was extracted from the roots to compare AM fungal community compositions in reference to fungal ribosomal RNA gene sequences.

Distinctive difference between the genotypes was that the susceptible genotype, but not the resistant genotype, exuded the most stable strigolactone 5-deoxystrigol. The levels of colonization and community compositions of AM fungi, however, were not different between the genotypes. These observations suggest that the difference in strigolactone stability is involved in susceptibility to *Striga* spp., but not in compatibility and host preference in AM symbiosis.

2. Differences in strigolactone exudation correlate with compatibility, but not with host preference, in arbuscular mycorrhizal symbiosis

Intraspecific variability in compatibility to AM fungi has been observed in a wide range of plants, but physiological traits that define the compatibility has not yet been clarified. In this chapter, the hypotheses that i) difference in capability of phosphorus acquisition would alter strigolactone exudation, ii) which leads to alterations of the levels of colonization and community compositions of the fungi. Three maize genotypes that are highly compatible to AM fungi and three low-compatible genotypes were grown in a glasshouse, and responses to phosphorus deficiency and AM fungi were compared. Strigolactones exuded by the six genotypes were collected in hydroponic culture, fractionated by HPLC, and assessed by *Orobanche minor*-seed germination test. The genotypes were grown in the field, and DNA was extracted from the roots to compare AM fungal community compositions. The responses of the genotypes to phosphorus deficiency and AM fungi were not correlated with their compatibility to AM fungi. The seed germination assay, however, revealed that germination stimulation activity was significantly higher in several fractions of the exudates form the highly-compatible genotypes. Despite the difference in strigolactone exudation, the community compositions of the fungi were not different between the highly-compatible and low-compatible genotypes. These results suggest that quantitative and/or qualitative differences in strigolactone exudation are involved in compatibility to AM fungi, but not in host preference in the symbiosis.

In contrast to the specific responses to structurally different strigolactones in the parasite-plant interactions, 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.