View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

東北大学機関リポジトリ
TOUR
Tohoku University Repository

Molecular Mechanisms Underlying P Translocation and Metabolism in Arbuscular Mycorrhizal Fungi

著者	SAITO Katsuharu
journal or publication title	Journal of Integrated Field Science
volume	15
page range	69-69
year	2018-10
URL	http://hdl.handle.net/10097/00124010

1-5. Molecular Mechanisms Underlying P Translocation and Metabolism in Arbuscular Mycorrhizal Fungi

Katsuharu SAITO

Faculty of Agriculture, Shinshu University

In soil, mineral concentrations are generally low and some minerals are unavailable for plants due to the formation of their precipitates or the fixation to soil particles. Plants have developed several strategies for mineral uptake from soil. For example, Plants secrete organic acids and enzymes to liberate available minerals from the precipitates and organic forms, and uptake soluble minerals via various transporters on plasma membrane. Other plant strategy for mineral uptake is the formation of symbiotic associations with fungi. Many land plants form symbiotic associations with arbuscular mycorrhizal (AM) fungi belonging to subphylum Glomeromycotina. Host plants can absorb minerals such as phosphate from soil via hyphal networks of AM fungi, which results in the improvement of plant nutrition and the increase of plant yield (Saito and Ezawa, 2016). The pathway of mineral uptake via AM symbiosis is called mycorrhizal pathway. On the other hand, the mineral uptake by plant roots from soil is known as the direct pathway.

The mycorrhizal effects on plant yield and P nutrition are obvious in the laboratory where growth conditions are well controlled. However, the mycorrhizal functions are not always effective in fields due to fluctuating environmental factors and the combinations of plant and fungal species. It is important to evaluate the mycorrhizal function in fields for utilizing AM symbiosis in agriculture using a diagnostic assessment for the activity of the mycorrhizal pathway. However, any procedure of the diagnostic assessment has not been developed because the mechanism underlying P uptake via mycorrhizal pathway remains unclear.

AM fungi uptake soil phosphate by phosphate transporters on plasma membrane in extraradical hyphae. Phosphate in hyphae is rapidly converted into polyphosphate, which then accumulates in fungal vacuoles and cell wall. Polyphosphate is translocated to intraradical hyphae and converted into short chain of polyphosphate. Phosphate liberated from polyphosphate is thought to be released from arbusculated hyphae into periarbuscular space.

We have investigated polyphosphate metabolism in AM fungi to elucidate molecular mechanisms underlying P transfer from AM fungi to the host plants. Several key genes in polyphosphate metabolism have been identified from both AM fungi and plant based on reverse genetics. Further, we analyzed gene expression profiles during AM fungal colonization using a next generation sequencing technology, and detected some candidate genes possibly involved in AM development and P metabolism (Handa et al., 2015). In this symposium, I will present our recent studies on P transfer between AM fungi and plants and discuss the development of a diagnostic assessment of mycorrhizal pathway in fields.

References

Handa, Y., H. Nishide, N. Takeda, Y. Suzuki, M. Kawaguchi and K. Saito (2015) RNA-seq transcriptional profiling of an arbuscular mycorrhiza provides insights into regulated and coordinated gene expression in *Lotus japonicus* and *Rhizophagus irregularis*. Plant and Cell Physiology, 56: 1490-1511.

Saito, K. and T. Ezawa (2016) Phosphorus metabolism and transport in arbuscular mycorrhizal symbiosis, F. Martin (Ed.), Molecular Mycorrhizal Symbiosis, John Wiley & Sons, New Jersey, pp. 197-216.