Understanding the Genetic Basis of Domestication-related Traits in Rice

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Cultivated rice, *Oryza sativa* L., domesticated from its wild ancestor, *O. rufipogon*, is an important crop that feeds almost one third of the world's population. The selection of many beneficial agronomic traits have resulted in increased yield and efficient cultivation practices that have supported human civilisations. The availability of rice genome data has not only helped in the elucidation of the genetic basis of such domestication-related traits, but has also enabled extensive analysis of rice genome sequence and determination of the origin of rice. Most of the domestication related-traits and genes are often evaluated in the genetic background of cultivated rice, leading to misinterpretation of rice domestication. In my study, domestication-related traits such as closed panicle and loss of seed shattering were evaluated in the genetic background of wild rice in order to focus on the early phase of rice domestication.

A simple morphological change in rice panicle shape, controlled by the *SPR3* locus, was found to have a large effect on seed-shedding and pollinating behaviour [1]. In the genetic background of wild rice, plants with a closed panicle, resembling cultivated rice had significantly reduced seed shedding through seed retention. In addition, the long awns in the closed panicles disturbed the free exposure of anthers and stigmas on the flowering spikelet, resulting in significantly reduced outcrossing. These results showed that a closed panicle trait was selected very early in rice domestication.

The loss of seed shattering trait is also a favourable phenotypic change, apparently selected during rice domestication. Previous studies have shown that two major quantitative trait loci (QTLs; *qSH1* and *sh4*) are involved in defining the non-shattering behaviour of cultivated rice. To understand their roles in seed shattering in early rice domestication, wild introgression lines having domesticated alleles at both loci were produced by backcrossing. Surprisingly, the plants still displayed seed-shattering behaviour, reminiscent of the involvement of additional genes in the loss of seed shattering trait. Genetic analysis using the wild introgression line identified an additional locus, *qSH3*. In addition, domesticated allelic interactions at both *sh4* and *qSH3* loci inhibit the formation of abscission layer, suggesting that the two loci may have played an important role in the loss of seed shattering trait during rice domestication [2].

Studies on such domestication-related traits in the wild genetic background will provide important information regarding how these traits were selected, in addition to clarifying the process of rice domestication.

References

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[2] Inoue C., Htun T.M., Inoue K., Ikeda K., Ishii T., Ishikawa R.: Inhibition of abscission layer formation caused by an interaction of two seed-shattering loci, *sh4* and *qSH3*, in rice. Genes Genet Syst. 90: 1-9 (2015).