9th Asia-Pacific Conference on Plasma Physics, 21-26 Sep, 2025 at Fukuoka

Elucidation of the molecular mechanism of low-temperature plasma treatment for transposon activation

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Although there have been reports of enhanced growth in plants treated with cold temperature plasma, the molecular changes underlying this phenomenon remain to be elucidated. It is plausible that this phenomenon is associated with alterations in the expression of associated genes. In the absence of mutations in the genome, it is reasonable to hypothesize that plasma treatment will result in alterations in gene expression. To elucidate the biological effects of plasma treatment on plant seeds, our primary objective is to detect the activation of transposons "mobile DNA," which are more abundant in the genome than genes. Transposons are sequences that move to other locations in the genome. Many transposons are repetitive sequences found in heterochromatin regions, with numerous copies of the same sequence present throughout the genome. However, they also give rise to diverse transposons through the accumulation of mutations. Transposons induce recombination within the genome by recombining their homologous sequences. Consequently, they can alter gene expression or function. In other words, transposon activation is one of the driving forces of evolution. The majority of these elements are in an inactive state, epigenetically repressed by DNA methylation and related mechanisms. Since plasma treatment is thought to affect the entire genome, we hypothesized that activating transposons would allow us to elucidate the molecular consequences of plasma irradiation. Consequently, an analysis was conducted on the rice mutant *pyl-stb* (Figure 1A), which enables the rapid assessment of transposon, *nDart* activity by utilizing variegated leaves as a biological indicator (Figure 1B). These *nDart* elements were non-autonomous, whose transposition was induced by an autonomous element *aDart1*[1]. The *nDart* elements shows a tendency to insert into the gene region, and it can be expected to select mutants that are useful for agriculture. Therefore, we tried to induce the activation of *nDart* elements by low-temperature plasma irradiation..

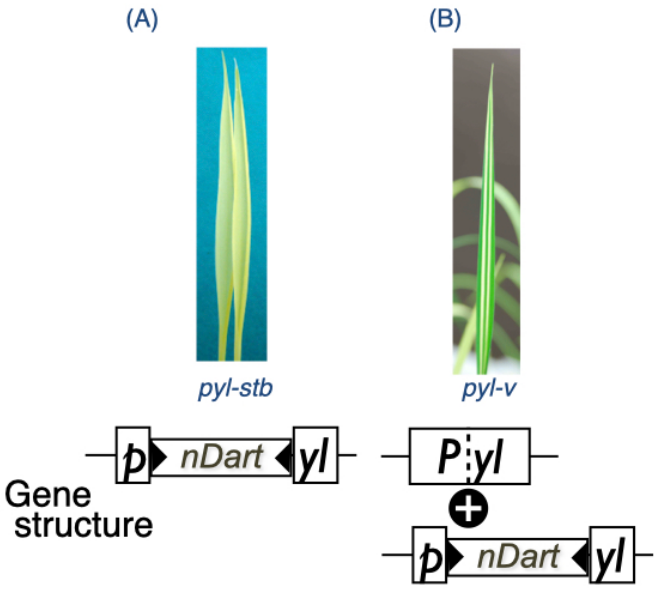

Figure 1 Phenotype of *pale-yellow leaf* (*pyl*) mutant and gene strucre. (A) *pyl-stable* mutans carrying transposon *nDart*. (B) *pyl-varigated* mutant containd functional *Pyl* gene and *nDart*-inserted pyl gene. The *pyl* genes are in a chimeric state In the *pyl-v* mutant

References
[1] Tsugane et al. Plant J. 45. 46. 2006