Transposon-mediated gene tagging and editing in oat

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Among various functional genomic tools to characterize genes in plants, transposon-based insertional mutagenesis approach offers great potential, especially in plant species, which possess large genomes and genetic transformation is not a routine. Oat (Avena sativa) is a globally-important cereal crop species with documented benefits to human health. However, oat has lagged behind other cereals with respect to genomic resources, due in part to the complexity of its hexaploid genome. Our aim in the current project is to introduce the Ac/Ds transposable elements in oat species for the development of a gene tagging resource with its potential for gene editing. Highly regenerative calli derived from mature oat seeds of oat cultivar ‘Park’, were successfully transformed with several Ac/Ds constructs, using a biolistic delivery system. Twenty-two independent transgenic events were obtained using two different antibiotic selection schemes. Our data indicate that co-transformation of Ac and Ds constructs led to 5% of primary Ds transpositions at T0 stage. Generation advance of T1 plants containing both Ac and Ds elements from four different events established the transposition frequency between 11 to 30%. Movement of Ds element was confirmed by histochemical and molecular assays. Homozygous oat lines containing individual Ac and Ds elements are being hybridized for further remobilization of Ds transposons in the oat genome. Reactivation of Ds elements from its original position has a great potential for gene editing of the insertion sites. Prospects of transposon-based gene editing will be discussed.