

Evolutionary study of PHOSPHOLIPID: DIACYLGLYCEROL ACYLTRANSFERASE (PDAT), an enzyme in neutral lipid biosynthesis between plants with high and low oil content

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Abstract: PHOSPHOLIPID: DIACYLGLYCEROL ACYL TRANSFERASE (PDAT) is an enzyme that catalyzes the transfer of a fatty acyl moiety from the sn-2 position of a phospholipid to the sn-3-position of sn-1,2-diacylglycerol, thus forming triacylglycerol and a lysophospholipid. In this study, we investigated the evolutionary relationship of the PDAT gene family across the high and low seed oil content plants using a comparative phylogenetic analysis. The PDAT candidate genes are present in both monocots and eudicots and phylogenetic analysis revealed the evolutionary division of the PDAT gene family into different clades. In silico studies reveal that there is distinct separation between monocot and dicot PDAT sequences. The separation can be supported by the conservation and variation in the gene structure, protein properties, motif patterns, and/or selection constraints. Phylogenetic analysis of the 76 full-length PDAT gene sequences was carried out. Our data related to both monocot and dicot PDAT revealed (Pi (a)/Pi(s) ratio values lower than one that it suggests negative or purifying selection for their PDAT gene populations. Tajima's D for both populations was negative. so it signifies an excess of low frequency polymorphisms relative to expectation, indicating population size expansion. The existence of multiple PDAT gene copies across eudicots suggests that the PDAT gene family expanded in eudicots. Gene copy number expansions can occur via three major evolutionary events: segmental duplication, tandem duplication, and transposition events. Overall, our study provides an insight into the evolution of the monocot and dicot plant PDAT gene family and explores the evolutionary mechanism underlying the functional diversification among the PDAT paralogs.

Keywords: phospholipid: diacylglycerol acyl transferase (PDAT), evolution, duplication, purifying selection, Tajima test.

References

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