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Dissertation title: The participation of DGAT (acyl-CoA: diacylglycerol acyltransferase) and PDAT (phospholipid:diacylglycerol acyltransferase) types of acyltransferases in accumulation of triacylglycerols in seeds of selected oilseed plants

Triacylycerols (TAG) are major storage lipids of most plants. Seed TAG content and fatty acid composition depends not only on the plant species, but also on the cultivar. TAG synthesis takes place in the plant cell's endoplasmic reticulum and consists of a series of subsequent glycerol chain acylations known as the Kennedy Pathway. In the last step of the pathway acyl group is tranferred from acyl-CoA to the *sn-3* position of diacylglycerol (DAG) by an enzyme known as acyl-CoA:diacylglycerol acyltransferase (DGAT). A TAG molecule is produced. However, there is an alternative ER pathway of TAG biosynthesis simultaneous to DGAT-mediated DAG acylation. In this alternative, an enzyme called phospholipid:diacylglycerol acyltransferase transfers the acyl group to the *sn-3* position of DAG not from acyl-CoA, but from a phospholipid.

In the presented work the activity of PDAT-type enzymes and the activity and substrate specificity of DGAT-type enzymes were investigated. Both enzyme types were studied in the microsomal fractions of developing seeds of the following plants: soybean (*Glycine max*), castor bean (*Ricinus communis*) and two cultivars of rapeseed (*Brassica napus*; the studied rapeseed cultivars were the low-erucic acid MONOLIT and the high-erucic acid MAPLUS cultivar). Relative expression measurements during seed development were also conducted for the four isoforms of DGAT1 and four isoforms of DGAT2 in both rapeseed cultivars. Genes encoding the aforementioned isoforms were cloned and expressed in *Saccharomyces cerevisiae*. Cloning and yeast expression enabled analysis of acyl-CoA substrate specificity of each isoform.

Results of the study show that the ratio of PDAT to DGAT activity largely depends on the investigated plant species and can change throughout seed development. It was also shown that the activity of the microsomal fraction DGAT of the tested seeds can be the highest at different stages of seed development. This observation can be explained by the independent changes in activities of different DGAT isoforms during seed growth and distinct acyl-CoA substrate specificities of those isoforms.

The acyl-CoA substrate specificity of *Bna*.DGAT1 isoforms is highly different from the acyl-CoA substrate specificity of *Bna*.DGAT2 isoforms. What is more, results show similarity between individual *Bna*.DGAT1 substrate specificities and significant differences between the *Bna*.DGAT2 isoforms substrate specificities. Two of *Bna*.DGAT2 isoforms present high specificity towards 18:3-CoA, while the other two are highly active with 22:1-CoA as the acyl group donour.

Obtained results do not show a correlation between relative expression of the studied *Bna*.DGAT isoforms and the activity and the substrate specificity of DGAT enzymes present in microsomal fractions from the developing seeds of studied rapeseed cultivars.

Studies conducted in this dissertation further expend current knowledge on mechanisms regulating the quantity and quality of oilseed-produced oils. The presented findings may be used to obtain modified oilseed plants with desired quality and/or quantity of seed oils in the future.