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Regulation of triacylglycerol biosynthesis and storage in plant vegetative tissues

Author (Intern and Mentor) Information

In plants, triacylglycerol (TAG, oil) is stored in a unique subcellular organelle known as oil droplets, which consist of a central matrix of TAG coated by a phospholipid membrane embedded with proteins called oleosins. In past years, plant oils have been explored as a solution for the world's growing food demand. More recently, plant oils have been utilized as feedstocks for the production of biodiesel and industrial chemicals. Despite its importance, very little is known about how TAG is synthesized and stored in the vegetative tissues of plants. The objective of this project was to develop a genetic screen for mutants defective in oil biosynthesis and storage in leaves. To achieve this goal, oleosin-green fluorescent protein (GFP) was overproduced in vegetative tissues of the model plant *Arabidopsis* to visualize the oil droplets. Then, seeds of homozygous transgenic plants carrying the oleosin-GFP transgene were mutagenized, sowed on soil, and allowed to self-pollinate, producing M2 seeds. To screen for oil accumulating mutants, M2 seeds were sowed on agar-solidified plates. The leaves from individual M2 plants were examined using fluorescence microscopy. Individual plants with an abnormal size and number of oil droplets were then transferred to soil. To characterize the putative mutants, leaf oil content and lipid composition of the adult putative mutant plants were analyzed by thin-layer chromatography. This screening method identified approximately twenty candidate mutants. If the mutations are indeed novel, they will help lay a solid foundation for future studies aimed at understanding the regulation of oil biosynthesis and storage in vegetative tissues at the molecular, genetic level. Also, the results could potentially have important implications strategies to develop new crops as renewable bioenergy sources. From this project, I have gained valuable experience learning and utilizing laboratory techniques including fluorescence microscopy and thin-layer chromatography.