Aleea Magras

Pilot Grove,MO

Junior
Biochemistry

Faculty Mentor: Dr. Abraham Koo, Biochemistry

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Impact of Rising Temperatures on Oil Content and Pest Resistance of Plants Engineered for Biofuel

Aleea J. Magras, Aidan Ireton, and Abraham J. Koo

As mean global temperature continues to rise, largely attributable to fossil fuel combustion, the need for renewable energy is evident. Efforts are underway to improve oil content in plants to use plants as an economically viable source of bioenergy, but little is known about the impact of increased oil on plant adaptations to stress. The purpose of this study was to examine the triple-faceted relationship among temperature, insect herbivory, and oil metabolism. Oil content in plant leaves was increased through ectopic overexpression of *LIPID DROPLET ASSOCIATED PROTEIN 1 (LDAP1)* under constitutive promoter in model plant *Arabidopsis thaliana (LDAP1-OE)*. Insect feeding trials showed that cabbage looper larvae raised on *LDAP1- OE* gained similar weight as those on wildtype (WT) control both under normal (22 °C) and moderately raised (30 °C) temperatures; however, the insect consumption rate was remarkably accelerated at 30 °C. This was mostly attributable to faster growth of insects under higher temperatures as was shown by insect growth assays conducted on artificial diet under different temperatures. Interestingly, when plants were pre-acclimated to 30 °C for five days before conducting the insect feeding trial at 22 °C, *LDAP1-OE* plants were found to be more susceptible to insect herbivory than similarly treated WT, indicating that increased temperature caused differential effects on the food quality of the two genotypes. Lipid profiling analysis using thin layer chromatography of leaf extracts revealed time-dependent increase of triacylglycerol, the major form of lipids in vegetable oil, by high temperature treatments in both genotypes with more significant changes in *LDAP1-OE*. Such differential oil accumulation may have contributed to the differential insect performance on each genotype, but more research is needed to establish the causal relationships. Future studies will adopt the use of other varieties of oil-engineered lines and genome scale analysis of gene expression and metabolites.