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Identification of SNP markers associated with soybean fatty acids across environments
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Fatty acids (FAs) in soybean seeds generally consist of 12% palmitic acid, 4% stearic acid, 24% oleic acid, 53% linoleic acid, and 7% linolenic acid. The composition of FAs is important for targeted use of the oil, and the proper contents of FAs are required for each soybean oil application. For example, cooking applications require reduced levels of the oxidatively unstable linoleic and linolenic acids. In regards to human health, increased consumption of palmitic acid is associated with risk of cardiovascular diseases, whereas consumption of oleic, linoleic, and linolenic acids can decrease blood levels of low density lipoprotein-cholesterol. FA-related genes or quantitative trait loci (QTL) have been widely investigated for marker-assisted breeding. Conventional QTL studies were primarily carried out in biparental populations with a small number of progeny. However, determination of the precise position of a QTL is typically limited by low number of recombination events in such populations. In order to overcome this limitation, we conducted a genome-wide association study (GWAS) for FAs with 621 soybean accessions and ~34,000 SNPs. The FAs contents in seed samples were measured by gas chromatograph from the accessions grown in five different environments: Columbus, OH (2015), Wooster, OH (2014 and 2015), Plymouth, NC (2015), and Urbana, IL (2015). Genomic Association and Prediction Integrated Tool (GAPIT) was used for analyses of GWAS data, and we identified 16, 26, 7, 6 and 3 significant SNPs associated with contents of palmitic, stearic, oleic, linoleic, and linolenic acid, respectively. The Palmitoyl-Acyl Carrier Protein Thioesterase (FatB1a) known as palmitic acid-associated gene locus on chromosome 5 and delta-9-stearoyl-acyl carrier protein desaturase C (SACPD-C), the steric acid-associated gene locus on chromosome 14 were identified by our study. These findings will be useful for further dissection of FA related QTL in soybean.