Kevin Chiteri[1], Shivani Chiranjeevi[2], Talukder Zaki Jubery[2], Ashlyn Rairdin[1], Baskar Ganapathysubramanian[2], and Arti Singh[1]

[1]Department of Agronomy, Iowa State University
[2]Department of Mechanical Engineering, Iowa State University

October 5, 2022

Abstract

Mung bean (*Vigna radiata* (L.) Wilczek) is an important crop providing protein, fiber, carbohydrates, and minerals in Southeast Asia and Africa. Trifoliate leaves in mung beans are central to several plant processes like photosynthesis, light interception, early disease & pest warning signals, and overall canopy architecture. We sampled more than 5000 leaf images of the Iowa Mung bean diversity panel (IMDP) during the 2020 and 2021 growing seasons in a Randomized Complete Block Design. We recorded the phenotypic diversity, developed a regression model for the oval leaflet type, and conducted GWAS for the image extracted traits. The diversity in the morphology included leaflet type (oval or lobed), leaflet size (small, medium, large), lobed angle (shallow, deep), and vein coloration (green, purple). A universal regression model $LA = b_0 + b_1L + b_2W + b_3L*W$ was the best at predicting the area of each ovate leaflet with an adjusted R^2 of 0.97. The candidate genes *Vradi01g07560*, *Vradi05g01240*, *Vradi02g05730*, and *Vradi03g00440* are associated with multiple traits (length, width, perimeter, and area) across the leaflets (left, terminal, and right) and would be suitable candidates for further investigation in their role in leaf development, growth, and function. Future studies will be needed to correlate the observed traits discussed here with yield or important agronomic traits for use as phenotypic or genotypic markers in marker-aided selection methods for mung bean crop improvement.

NAPPN Annual Conference Abstract: Combining Image Analysis and GWAS to Dissect the Genetic Architecture of Mung Bean Leaf Morphology Traits

Kevin Chiteri[1], *Shivani Chiranjeevi*[2], *Talukder Zaki Jubery*[2], *Ashlyn Rairdin*[1], *Baskar Ganapathysubramanian*[2], *Arti Singh*[1]

[1]*Department of Agronomy, Iowa State University, Ames, IA, USA*

[2]*Department of Mechanical Engineering, Iowa State University, Ames, IA, USA*

ORCiD: [0000-0001-6067-5569]

Keywords: mung bean, gwas, regression, leaf morphology, RCBD

Mung bean (*Vigna radiata* (L.) Wilczek) is an important crop providing protein, fiber, carbohydrates, and minerals in Southeast Asia and Africa. Trifoliate leaves in mung beans are central to several plant processes like photosynthesis, light interception, early disease & pests warning signals, and overall canopy architecture. We sampled more than 5000 leaf images of the Iowa Mung bean diversity panel (IMDP) during the 2020 and 2021 growing seasons in a Randomized Complete Block Design. We recorded the phenotypic diversity, developed a regression model for the oval leaflet type, and conducted GWAS for the image extracted traits. The diversity in the morphology included leaflet type (oval or lobed), leaflet size (small, medium, large), lobed angle (shallow, deep), and vein coloration (green, purple). A universal regression model $LA = b_0 + b_1L + b_2W + b_3L*W$ was the best at predicting the area of each ovate leaflet with an adjusted R^2 of 0.97. The candidate genes *Vradi01g07560*, *Vradi05g01240*, *Vradi02g05730*, and *Vradi03g00440* are associated with multiple traits (length, width, perimeter, and area) across the leaflets (left, terminal, and right) and would be suitable candidates for further investigation in their role in leaf development, growth, and function. Future studies will be needed to correlate the observed traits discussed here with yield or important agronomic traits for use as phenotypic or genotypic markers in marker-aided selection methods for mung bean crop improvement.