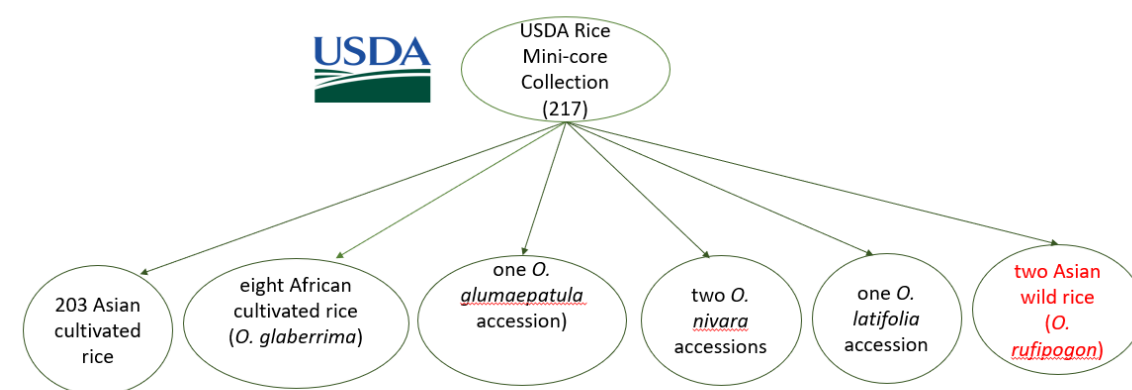


Phenotypic Variation and Genome-Wide Association Study of Seed Traits in the USDA Rice Mini-Core

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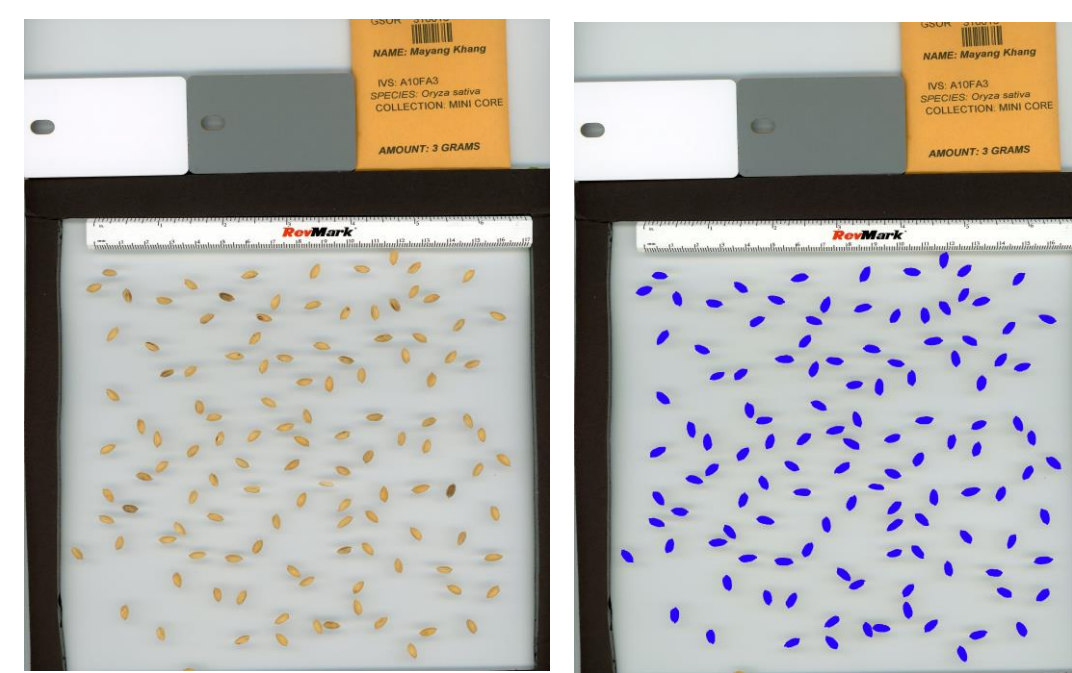
Introduction

- Rice is a major staple crop that can potentially help meet the demand for future food supply for the world's expanding population.
- The development of elite rice cultivars with a higher yield, quality, and stress adaptation is largely dependent on the genetic diversity of rice germplasm input into breeding programs.
- Aim:** To test for genotype-trait associations for seed shape and size by leveraging the genetic diversity of the USDA mini-core collection.



Methods

- 201 diverse accessions & 40,866 SNP markers
- Seed scan (Epson V600)
- Seed trait phenotyping (PlantCV)
- Statistical Analysis (R package)
- GWAS (GAPIT3 R package)

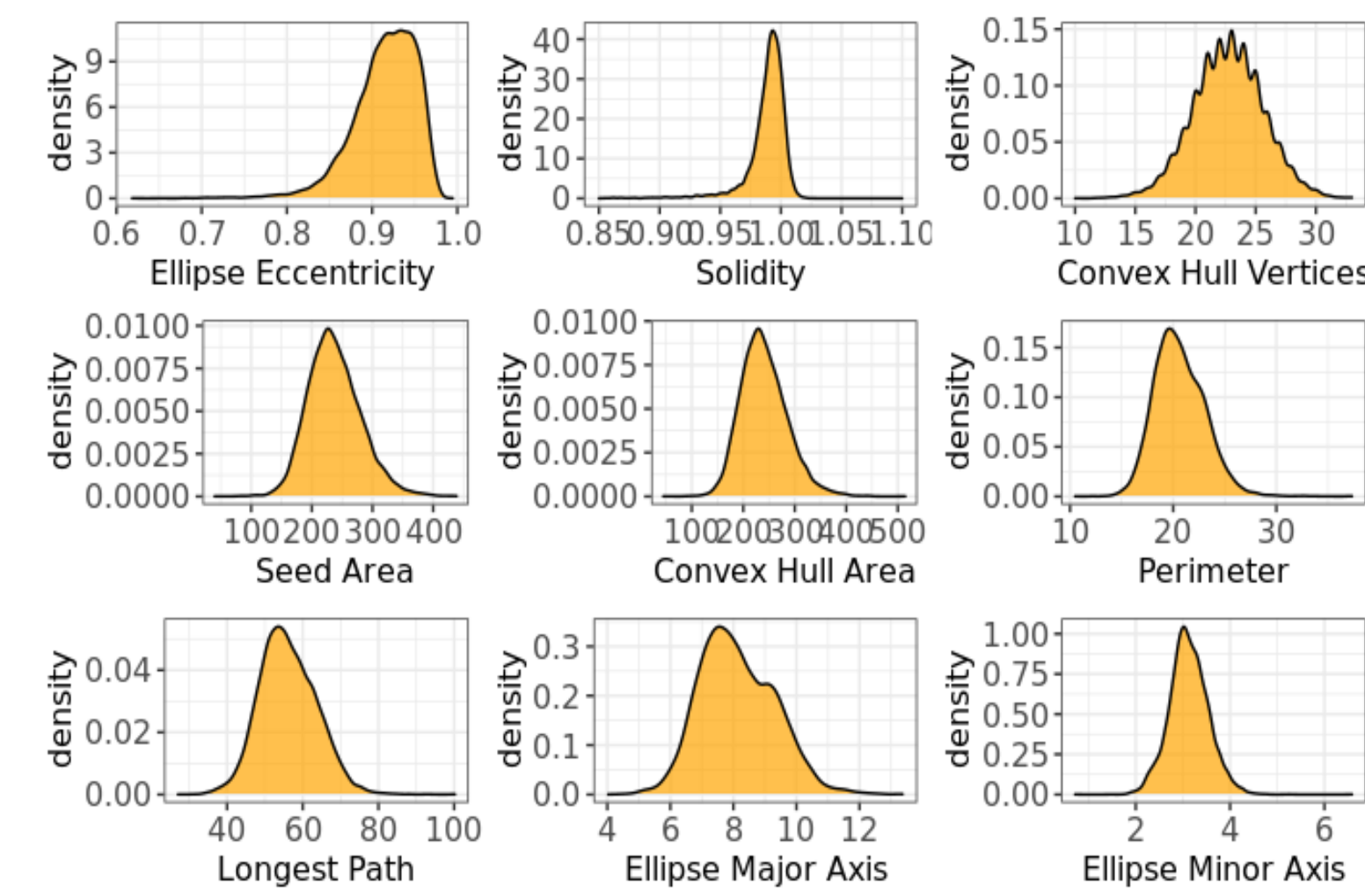


Seed scan setup

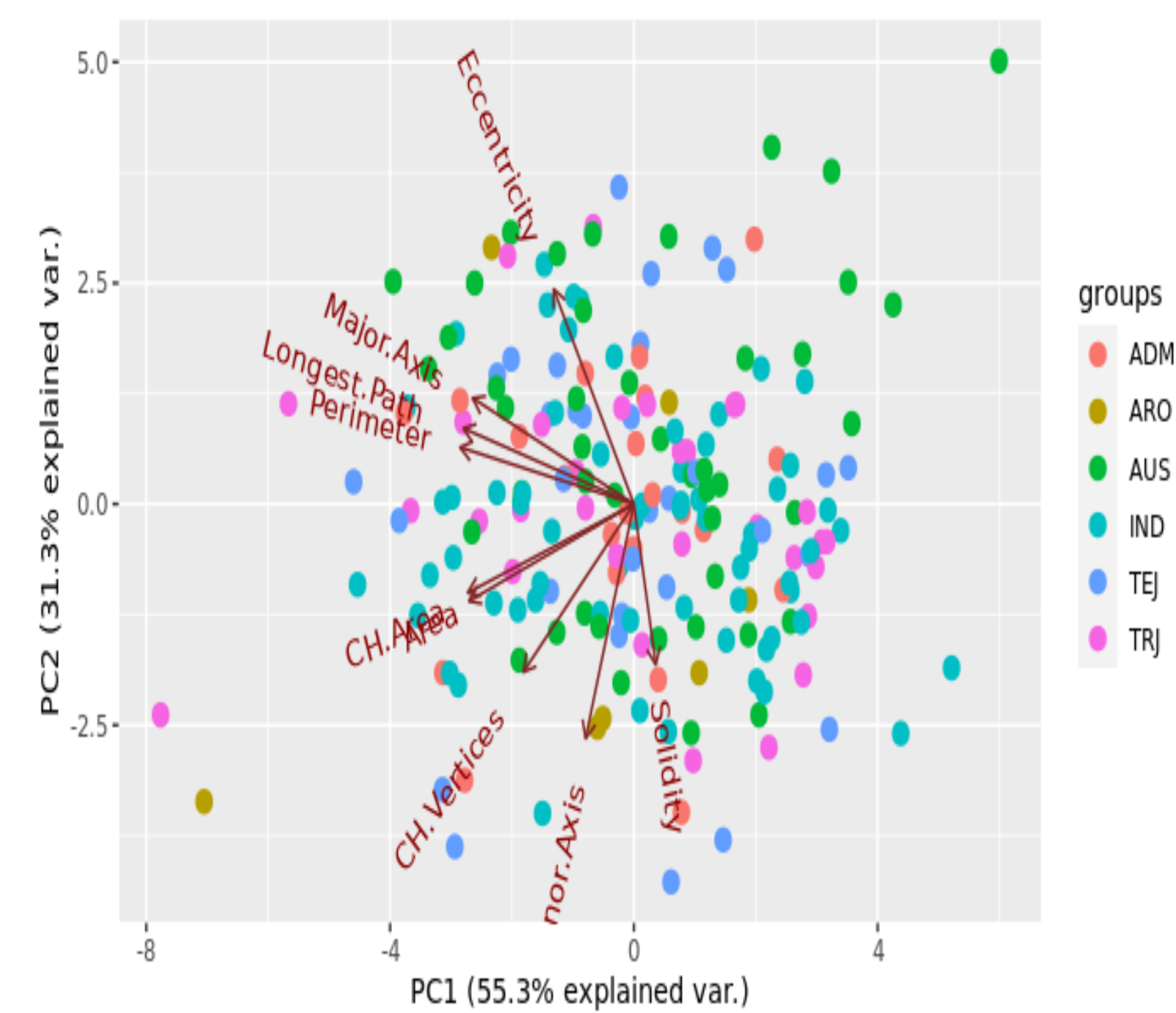
Seed analysis with PlantCV

Acknowledgements: Thanks to the Genetics Society of America (GSA) DeLill Nassar Award for professional development funding. Thanks also to Trevis Huggins and the USDA for sharing germplasm resources and expertise.

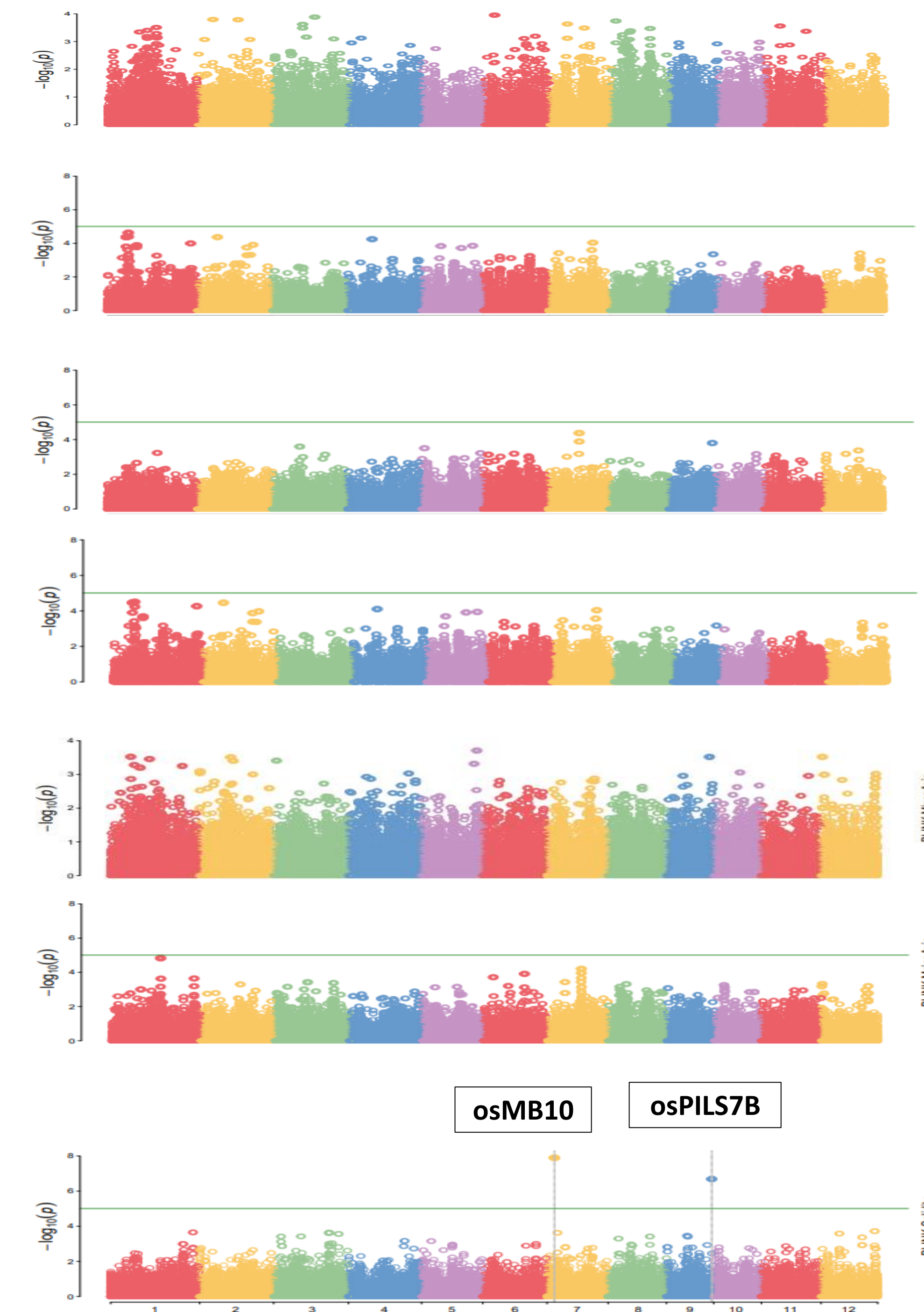
Results



Trait distribution curves



Projection of individual trait phenotypes on the first two axes of the principal component analysis (PCA)



Manhattan plots for all studied traits with Blink model

Discussion

- Are our GWAS underpowered? Let's chat about ideas!
- Two significant SNPs for solidity trait were identified upstream of *osMB10* and *osPILS7b* genes on chromosomes 7 and 9 respectively:
 - osMB10* is similar to the POZ domain, a versatile protein interaction motif involved in a wide range of cellular functions.
 - osPILS7b* is similar to the auxin efflux carrier protein.
- Solidity is the ratio of grain area to the convex hull drawn around it. It is used to infer seed shape: values below 1 indicate bigger convex hull and, likely, seeds with abnormal shape.

References

- Marrano, A., & Moyers, B. T. (2022). Scanning the rice Global MAGIC population for dynamic genetic control of seed traits under vegetative drought. *Plant Phenome Journal*, 5: e20033.
- Jian-Min Song, Muhammad Arif, Yan Zi, Sing-Hoi Sze, Meiping Zhang, Hong-Bin Zhang, Molecular and genetic dissection of the USDA rice mini-core collection using high-density SNP markers, *Plant Science*, Volume 308, 2021, <https://doi.org/10.1016/j.plantsci.2021.110910>.
- Gehan MA, Fahlgren N, Abbasi A, et al. PlantCV v2: Image analysis software for high-throughput plant phenotyping. *PeerJ*. 2017;5:e40888. Published 2017 Dec 1. doi:10.7717/peerj.40888.