Fine mapping and marker development for *H34*, a Hessian Fly resistance gene in Wheat

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Abstract (300 word limit)

Statement of the Problem:

Wheat is a major staple food crop worldwide and various insect pests and pathogens cause significant grain yield losses to the crop every year. Among them, Hessian fly (*Mayetiola destructor*, HF) is a major destructive pest that can significantly reduce the wheat yield. To date, 35 HF resistance genes have been named. However, lack of diagnostic markers for these genes hampers their deployment in wheat breeding. Most of them have been mapped within cluster of NBS-LLR encoding genes but no HF-R genes have yet been cloned. *H34* is a Hessian fly resistance gene, confers high level of resistance against many Hessian fly biotypes.

Methodology and Theoretical Orientation:

H34 was previously mapped on the short arm of chromosome 6B using an F_{12} recombinant inbred line (RIL) population of Ning7840 x Clark. For fine mapping, a cross was made between two RILs, RIL115-S and RIL118-R contrasting for *H34* alleles, and 286 F3 lines were generated to identify heterogenous inbred families (HIFs). Fine mapping using HIFs and SNPs developed from 90K SNP chips delimited *H34* in a 4.5 Mb interval. Genotype-by-sequencing (GBS) analysis of the four pairs of near-isogenic lines (NILs) from the selected HIFs identified additional SNPs in the *H34* region that further narrowed the *H34* region to 670 kb. Also, under this region, three differentially expressed genes are identified from RNA-seq data which are likely to be the candidate genes.

Findings and Conclusion:

The tightly linked flanking markers can be used in marker-assisted selection of *H34* in wheat breeding programs. The successful fine mapping of *H34* has laid the foundation for cloning of the gene. Moreover, this research will provide evidence that plant-pathogens and insects share the attack strategy and are targeted by the specific type of R-gene mediated resistance.

Recent Publications (minimum 5)

1. Ali, Z., Rana, R.M., Cheema, H.M.N., Ahmed, Z., Maqbool, R., Ma, X., Ali, A. and **Ghori, N**. 2018.Genomics Based Plant Breeding, Plant Breeding Book Chapter. 209-224. http://onlinebooks.uaf.edu.pk/ChapterView.aspx?ChapId=370
2. Xu Xincheng, Zulfiqar Ali*, Song Weiyi, **Nida Ghori**, Shao Hongbo and Ding Jinping. 2016. Alterations of DNA methylation in diverse grafted hybrid tomatoes (*Lycopersicon esculentum* mill.). Pak. J. Agri. Sci. 53: 1.
3. Ashraf, S., Khaliq, A., Maloq, S., Amin, W., **Ghori, N.,** Naseem, I. and Ashraf, S. 2015. Combining ability analysis breeding approach to develop wheat genotypes: A review. Acad. J. Entomol.
4. Ali, Z., A.S. Khan, I. Karim, M. Uzair, T. Mahmood, T. Saeed, S. Sarwar, **N. Ghori**, Z. Nisar, S.S. Sarwat, A. Qayyum and A.A. Khan. 2014. Generation mean effects, heterosis and heritabilities for seedling, adult and physiological salinity tolerance in spring wheat (*Triticum aestivum* L.). Int. J. Agric. Biol. 16: 1059-1066.
5. Hussain, Z., Zafar, M.B., **Ghori, N.,** Mustafa, H.S.B., Ejaz-ul-Hassan, Mahmood, T. and Muddasir, M. 2016. Acclimatization of Mustard (*Brassica juncea* L.) Genotypes under Different Agro-Climatic Zones of Punjab Province, Pakistan. Researcher. 8(4):43-47.



Biography (150 word limit)

I am Nida Ghori, Fulbright PhD candidate in department of Agronomy, working with Dr. Guihua Bai and Dr. Allan Fritz at the Kansas State University, USA. During Masters, my research focus was to determine the genetic polymorphism of *TaZnF* gene family and its association with drought and yield related traits in wheat. After completing my degree, I joined the Department of Plant Breeding and Genetics in the same university as lecturer and worked on different research projects in wheat research group of the department. In 2017, I won world's most prestigious Fulbright scholarship to pursue my PhD studies in USA. My PhD research is aimed at development of markers for Hessian fly screening and map-based cloning of *H34* resistant gene in wheat. I am highly passionate to devote my life in improving the wheat yield by fighting against insects and pathogens.

Thank you

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