Characterization of germination associated thaumatin-like proteins in barley

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Abstract

Thaumatin-like Proteins (TLPs) belong to the PR-5 gene family of pathogenesis-related (PR) proteins. Their role in biotic and abiotic stress tolerance is well documented in the literature. Recent studies indicate that one of the *TLP* genes, *HvTLP8* interacts with β-glucan during seed germination and could influence malting quality traits. β-glucan is the major non-starch dietary fiber present in the barley grain, a low amount of which is a desirable trait for the malting barley breeding and brewing industry. Higher expression of *HvTLP8* correlates with the low amount of (1,3,1,4)-β-glucan and vice versa. The current project aims to discover and characterize the *TLP* gene family and investigate *HvTLP8* for its potential as a molecular marker for the identification and breeding of malting barley genotypes. Genome-wide exploration of the *TLP* gene family has identified 19, 28, 35 and 37 genes in barley, *Brachypodium*, sorghum and rice, respectively. Expression analysis was performed for the *TLP* genes in barley during 16-96 hrs of grain germination in malting and feed varieties. Transcript abundance of *HvTLP14*, *HvTLP17* and *HvTLP18* varies at different grain germination stages in Morex (malting variety) and Steptoe (feed variety). Based on this preliminary observation and the presence of the sugar-binding domain, one *TLP* candidate, *HvTLP17*, was identified for further investigation. The expression of *HvTLP17* was explored in two malting and two feed varieties using qRT-PCR. Additionally, we found out that *HvTLP8* expresses antagonistically to *HvSPL3* and *HvSPL23* during barley seed germination. Efforts were made to check the transcriptional regulation of *HvTLP8* and endoglucanase activity of recombinant HvTLP8 protein expressed using *E. coli* and yeast expression systems. For utilization of *HvTLP8* as a functional genetic marker for malting traits, an SNP in the 3' UTR downstream region was identified, which was then correlated with malting traits data from Steptoe X Morex doubled haploid mapping population. The findings of this thesis highlight the *TLP* gene family in cereals and their potential role during barley germination, including their association with β-glucan activity.

About the Candidate: Irfan completed his BSc. and MSc. at PMAS-Arid Agriculture University Rawalpindi, Pakistan. Irfan joined the department of plant science as a PhD student under the supervision of Dr. Jaswinder Singh in Fall, 2016. During his PhD, he presented his research work at different conferences organized by CSPB, ASPB and CSA. He got the CSPB president's award for 3rd best poster presentation at the Plant Biology conference in 2018. In addition to research, Irfan likes to play basketball, badminton, volleyball and soccer.