

# Asian Citrus psyllid expression and corrections of Aquapoin Genes

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**Abstract:** One of the most popular morning drinks, orange juice is threatened by a disease called citrus greening (*Candidatus Liberibacter asiaticus*). [JB1] The vector is the Asian citrus psyllid (*Diaphorina citri* Kuwayama). The spread of citrus greening is typically reduced by chemical insecticides which have negative environmental impacts since these chemicals can kill other insects beyond the target pest. To make a specialized insecticide and have better understanding of this plant disease vector, we examined the recently updated genome of Asian citrus psyllid (ACP). In specific, we improved information on the aquaporins, which are integral membrane proteins primarily responsible for transporting water. We identified at least 8 aquaporin genes with multiple splice variant based on comparison to other insect systems. These characterizations were followed by examining gene expression of each aquaporin based on previously conducted RNA-seq studies. By understanding the ACP genome, we hope to improve understanding on this pest and develop new targets for control.

**Introduction :** Citrus greening (*Candidatus Liberibacter asiaticus*) / Huanglongbing (HLB) is a devastating diseases for all citrus plants, and there is currently no adequate control strategy(1).The Asian citrus psyllid (*Diaphorina citri* Kuwayama ) transmits the bacteria to the tree when feeding on new shoots. Affecting citrus production, infected trees will have stunted growth, produce fewer fruit that are smaller, have misshapen leaves and fruit that have a bitter taste(2). The tree dies in a few years from it. Asian citrus psyllid was first detected in Florida in 1998, spread to Texas in 2001, California in 2008, and Arizona in 2009 and now in all state that produce citrus fruits like oranges, lemons, and mandarins(2). Citrus greening was first identified in August 2005 in Florida. As of now the disease is affecting 80% of citrus trees in Florida. Which produces 66% of the total US Citrus production 85% oranges (96% juiced) and 12% grapefruit (58% juiced)(1).

In this study we look at expression and improved information of Aquaporin Genes. Aquaporins encodes a small integral membrane protein with six bilayer spanning domains that functions as a water channel protein. This protein permits passive transport of water along an osmotic gradient(4). They are found in all plants and living organism. So understanding how this gene function will help improve our knowledge on treatments for diseases for both plants and animals.

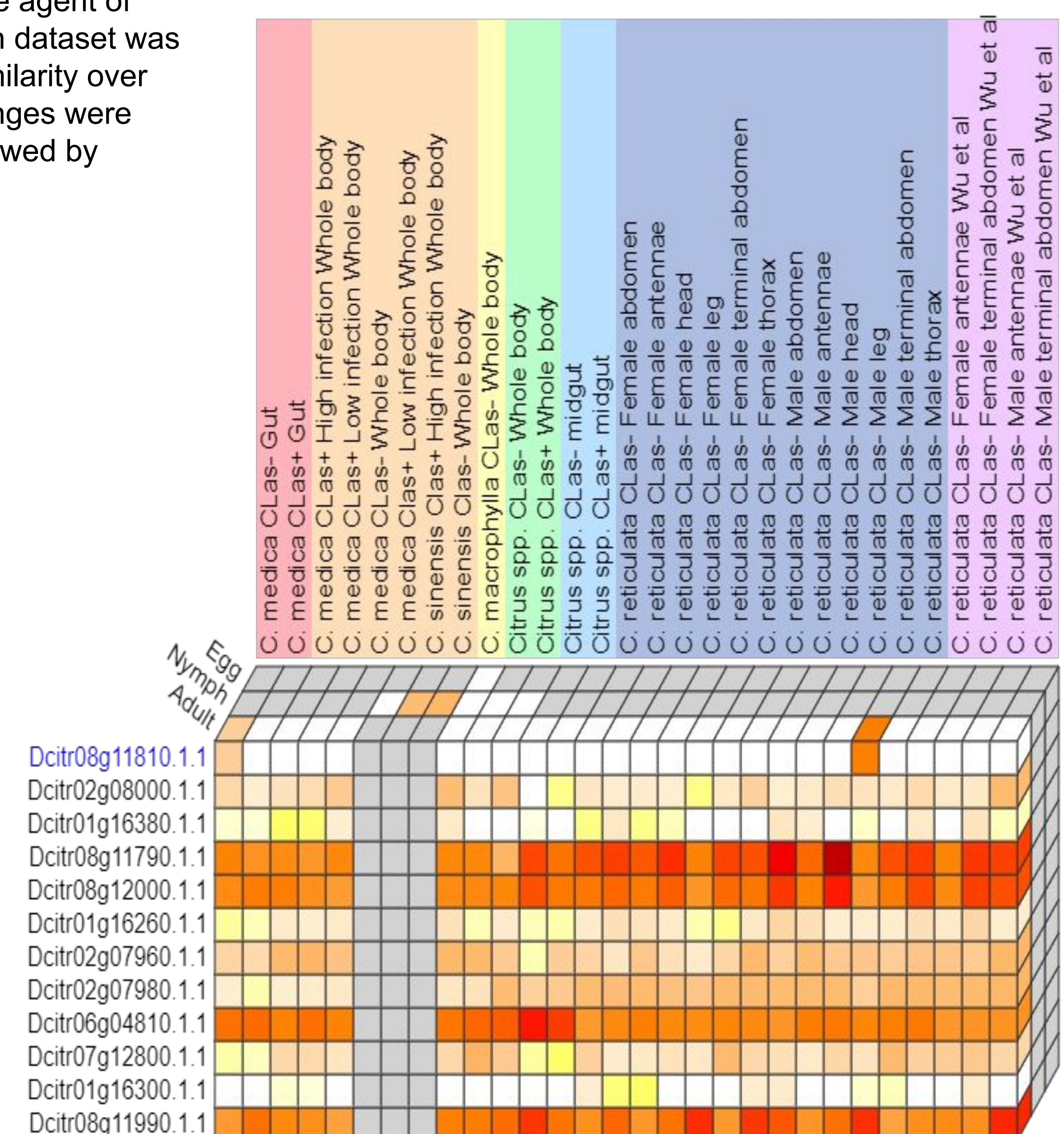
**Methods:** Genome sequences, predicted genes, and proteins were acquired from citrusgreening.org. Aquaporins genes were identified by scanning the amino acid sequences of a predicted protein coding gene for putative DNA binding proteins according to methods developed for other insects systems. The sequences were examined through the use of CLC MainWorkbench and blasted at NCBI.

- RNA-seq analyses was conducted based on methods in Benoit et al(3). Datasets were acquired from the NCBI Sequence Read Archive (BioProject: PRJNA385527). These datasets feature guts of *D. citri* who fed on citrus with and without the causative agent of citrus greening (CLAs). Datasets were trimmed with CLC Genomics (CLC Bio) and quality was assessed with FastQC. Each dataset was mapped to the predicted gene sets from the Asian citrus psyllid using CLC Genomics. Each read required at least 90% similarity over 60% of length, allowing two mismatches. Transcripts per million (TPM) was used as a proxy for gene expression. Fold changes were determined as the TPM in one sample relative to the TPM of another dataset. The Baggerly's test (t-type test statistic) followed by Bonferroni correction at 0.01. Predicted TFs were used for the final analyses.

**Summary:** We identified at least 8 aquaporin genes with multiple splice variant based on comparison to other insect systems. Characterizations was followed by examining gene expression of each aquaporin based on previously conducted RNA-seq studies. Helping to improve understanding on this pest and develop new targets for control.



From <http://www.thesurvivalgardener.com/a-quick-visual-guide-to-identifying/>



The figure above is aquaporin expression from Psyllid Expression Network.

## References:

- <https://www.citrusgreening.org/disease/index>
- <https://www.aphis.usda.gov/aphis/resources/pests-diseases/hungry-pests/the-threat/citrus-greening/citrus-greening-hp>
- Benoit et al. 2018 <https://www.nature.com/articles/s41598-018-24893-z>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6696234/>