

OFFICIAL ABSTRACT and CERTIFICATION

Elevated temperature and DNA methylation affects Mago nashi expression and sexual development in ?Ceratopteris richardii

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Climate change, specifically elevated temperature, has been previously correlated with a significant decrease in crop yield. High temperatures been shown to increase male sterility, reduce pollen viability and decreased seed yield. The molecular mechanisms by temperature stress affect sexual differentiation and fertility is not well characterized. This study used the fern *Ceratopteris richardii* as model organism to understand how elevated temperature would affect male and hermaphrodite differentiation of gametophytes and subsequent sporophyte production.

To identify possible genes that might be regulated by high temperature and is required for sexual development, we analyzed microarray data from the seed plant *Arabidopsis thaliana*. The gene *Mago nashi* was significantly upregulated. Using BLAST analysis, we identified an orthologue of *Mago nashi* in *Ceratopteris*. Phylogenetic analysis revealed that *Mago nashi* evolved before the separation of seed from seedless plants and the structural domains are highly conserved, suggesting a conservation of functions. RT-PCR revealed that there is greater expression of *Mago nashi* in males than hermaphrodites. Factors that promoted more male development in *Ceratopteris* such as high temperature and 5-azacytidine, an inhibitor of DNA methylation, resulted in greater expression of *Mago nashi* when compared to the controls.

This study demonstrated that an orthologue of *Mago nashi* gene is affected by temperature changes. Regulation of the expression of this gene also involved an epigenetic mechanism i.e. DNA methylation. Future knockdown studies of *Mago nashi* via RNAi would further support the importance of *Mago nashi* in sexual differentiation and fertility.

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