Studying the active role of the maize B chromosome in the modulation of gene expression

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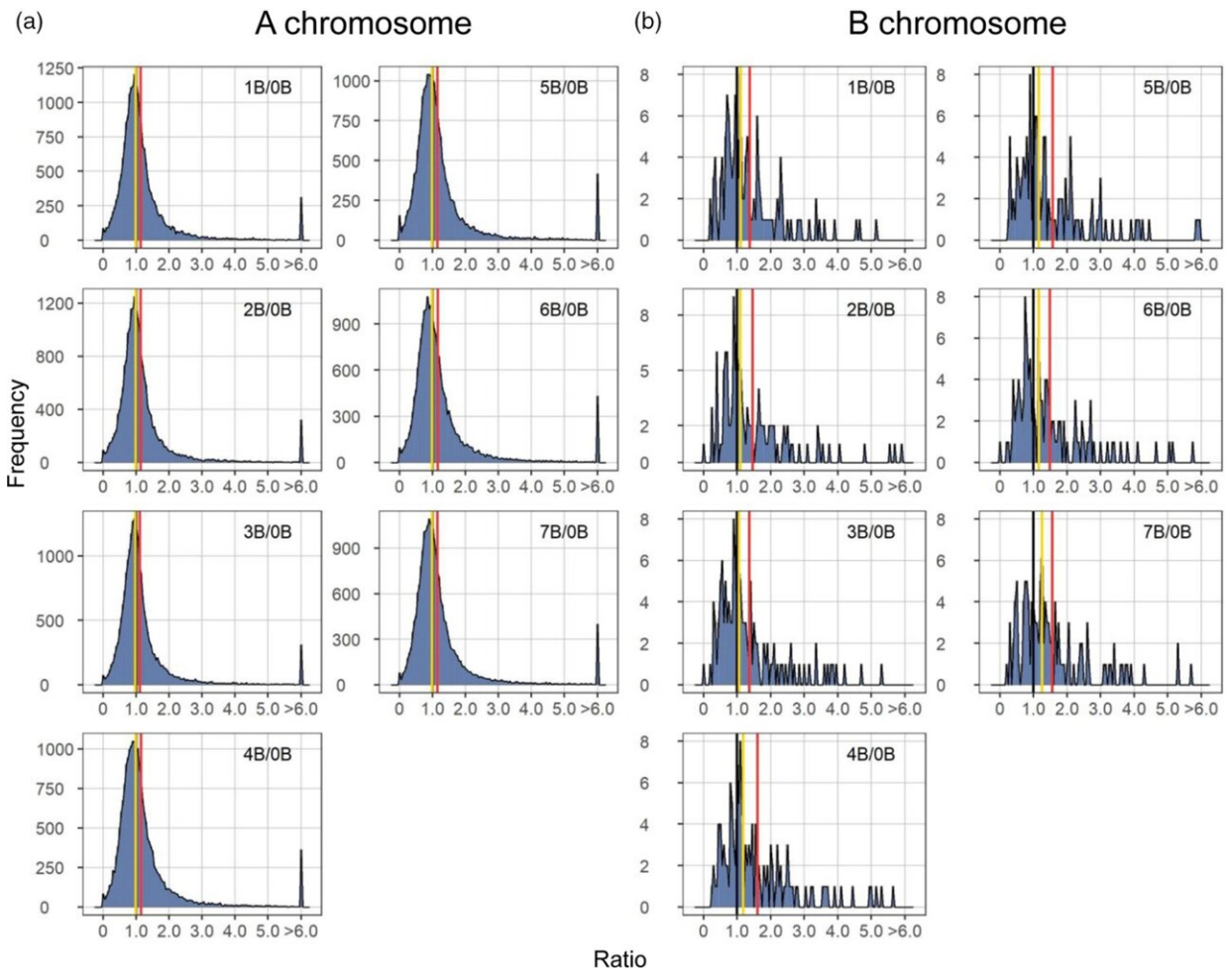

Figure 1. Ratio distributions of gene expression in each experimental genotype compared with the control. (a) Ratio distributions of A-located genes. (b) Ratio distributions of B-located genes with outliers (ratio > 6 or The Plant Journal

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A team of University of Missouri biologists has made a new discovery that provides novel insights into the function and properties of the maize B chromosome. The study was led by Dr. Xiaowen Shi and Dr. Hua Yang, postdoctoral fellows in the Birchler lab, and reported in the January 2022 issue of the *Plant Journal*.

Apart from the 20 normal A chromosomes, maize contains a nonessential B chromosome that can be present or absent from some individuals within a population. This chromosome has properties that drive its transmission in populations despite being nonessential. The maize B chromosome has wide applications in various genetic studies, including experimental mapping, chromosomal dosage studies, chromosomal behavior, and genetic engineering of minichromosomes. Although the maize B chromosome was discovered nearly a century ago, it has been thought to be an essentially inert chromosome. However, little was known about the function and properties of the maize B chromosome.

In a study investigating the effect of the B chromosome on gene expression through RNA sequencing, the authors demonstrate that 273 out of 758 predicted B chromosome-located genes are actively transcribed in leaf tissue. The B chromosome causes differential expression of genes, microRNAs (miRNAs), and transposable elements (TEs). Modulations of A chromosome-located genes are largely determined by the presence rather than the copy number of the B chromosome. By contrast, the expression of most B chromosome-located genes is positively correlated with B copy number, showing a proportional gene dosage effect. Furthermore, A chromosome-located miRNAs participate in the regulation of A chromosome gene expression

under the impact of the B chromosome and could potentially modulate its targets in a cascade of effects.

The study demonstrates that the B chromosome is not totally inert. The presence of the B chromosome results in changes in gene expression both transcriptionally and post-transcriptionally. An increase of B copy number causes both cumulative effects and non-cumulative effects on the expression of genes, miRNAs, and TEs.

More information: Xiaowen Shi et al, Effect of aneuploidy of a non-essential chromosome on gene expression in maize, *The Plant Journal* (2022). DOI: 10.1111/tpj.15665

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