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Genetic control of leafy head upon microRNA coordination

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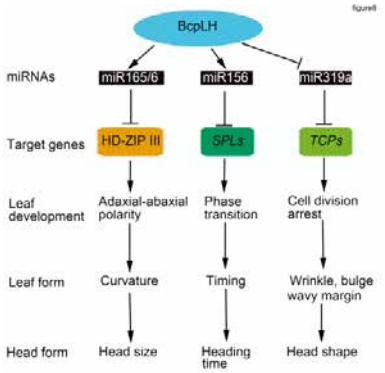
Leafy head and bulb are a type of agricultural products composed of incurved leaves. Many crops with these products undergo a leaf curvature transition from downward to inward upon aging. In a previous study, we used flat and upwardly-curved leaves of Chinese cabbage (Brassica campestris ssp. pekinensis) to clone the Bcp leafy heads (BcpLH) gene. Here we report that BcpLH controls a composite trait of heading through microRNAs. In the transgenic plants of Chinese cabbage, BcpLH antisense lowers BcpLH protein contents, causing the earliness of leaf incurvature and heading with a round-to-oval head shape transition; and its Arabidopsis ortholog HYL1 inhibits BcpLH activity, resulting in the lateness of heading, due to the incorrect cleavage sites in a subset of primary miRNAs that are competent to bind BcpLH and the altered interrelationship between miRNA pathways that interact genetically. Using QTL mapping of head traits within a population of 150 recombinant inbred lines (RILs) of Brassica rapa, we investigated the relationship between expression levels of miRNA-targeted BrpTCP4 genes and head shape. Herein, we demonstrate that a cylindrical head shape is associated with relatively low BrpTCP4-1 expression, whereas a round head shape is associated with high BrpTCP4-1 expression. In the round-type Chinese cabbage, miR319 accumulation and BrpTCP4-1 expression decrease from the apical to central regions of leaves. Overexpression of Brp-MIR319a2 reduced the expression levels of BrpTCP4 and resulted in an even distribution of BrpTCP4 transcripts within all leaf regions. Changes in temporal and spatial patterns of BrpTCP4 expression appear to be associated with excess growth of both apical and interveinal regions, straightened leaf tips, and a transition from the round to the cylindrical head shape. These results suggest that the miR319a-targeted BrpTCP gene regulates the round shape of leafy head via differential cell division arrest in leaf regions. Therefore, manipulation of miR319a and BrpTCP4 genes are potentially important tools for use in the genetic improvement of head shape in these crops. Our findings suggest that plant coordinates miRNAs for interplay between aging and morphological transitions.



Biography

Yuke He has his expertise in understanding the mechanisms of miRNA biogenesis and post-transcriptional gene silencing. He focuses on molecular mechanisms of major development processes controlled by the microRNAs and the targeted genes that direct leaf polarity, auxin response, and cell division; genetic mechanisms of leaf curvature and organ modification in *Brassica* crops; identification of key genes responsible for heat resistance; and molecular breeding of *Brassica* crops.

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