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Epigenetic control of leafy heads in *Brassica* crops

Leafy head is one type of important vegetable product composed of incurved leaves. Several crops producing leafy head show the leaves with downward curvature, flatness and incurvature at seedling, rosette and heading stages, respectively. Physiological studies have shown that the formation of leafy head is affected by internal elements such as C/N ratio and source/sink ratios and environmental factors such as temperature, light intensity and photoperiod. However, genetic basis for formation of leafy heads is unclear. In the previous study, we used flat and incurved leaves of Chinese cabbage to isolate *BcpLH* (*Brassica campestris* ssp. *pekinensis* Leafy Heads) gene from a cDNA library by differential hybridization. By Agrobacterium-mediated transformation, we transferred *brp-miR319*a gene to a round-head variety. In the transgenic lines, *miR319a*-targeted genes were down-regulated, while the round heads were modified into oblong heads. In the head leaves of the transgenic plants, *TCP* genes were downregulated by exogenous *miR319a*. The marginal regions of lateral areas in these head leaves were extremely wavy and knotted, apparently due to prolonged and enhanced cell division and vein differentiation in hydathode regions. The accumulation and distribution of *miR319*a in head leaves affect head shape, and artificial miR319a is useful for genetic improvement of head shape for favorable vegetable products. On the other hand, we found that *BrpSPL9*-2 (*Brassica rapa* ssp. *pekinensis Squamosa Promoter Binding-Like 9-2*), a target gene of microRNA brp-*miR156*, controls the heading time of Chinese cabbage. Overexpression of a *miR156*-resistant form of *BrpSPL9* caused leaf curvature (folding) to occur much earlier, causing early time of leaf heading. By contrast, overexpression of *miR156* delayed leaf curvature so it occurred in later leaves, resulting in a delay of leaf heading. *BrpSPL9* genes control heading time by accelerating adult development, and thus are potentially important for genetic improvement of earliness of Chinese cabbage and other crops. On the other hand, natural antisense transcripts of flowering inhibiting genes *BrpFLC* tune the timing of head maturity by regulation of the flowering time. Our findings suggest that *miRNA*s and non-coding RNAs control the shape, size and timing of leafy head in Brassica crops, thus provide an innovative approach to epigenetic manipulation of agricultural products.

Biography

Yuke He graduated from Horticulture Department, Northwestern Agricultural University in Dec of 1981, studied in Institute for Horticultural Plant Breeding, Wageningen, The Netherlands from 1985 to 1987, and got Ph.D. degree from Biology Department, Lanzhou University in June of 1991, worked as post-doc in Shanghai Institute of Plant Physiology, Chinese Academy of Sciences from 1991-to 1993, and worked as associate professor in Horticulture Department, Northwestern Agricultural University from 1987 and professor in Shanghai Institute of Plant Physiology & Ecology, Chinese Academy of Sciences from 1993, and acted as the deputy director of Shanghai Institute of Plant Physiology & Ecology, Chinese Academy of Sciences during 2011-2015, and the head of Joint Lab of Molecular Breeding from 2010.

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