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ALLELIC VARIATION OF *MYB10* IS THE MAJOR FORCE CONTROLLING NATURAL VARIATION IN SKIN AND FLESH COLOR IN STRAWBERRY (*FRAGARIA* SPP.) FRUIT

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Fruits of diploid and octoploid strawberry (*Fragaria* spp.) show substantial natural variation in both skin and flesh color due to distinct anthocyanin accumulation and distribution patterns. Expression of structural genes involved in anthocyanin biosynthesis is controlled by transcription factors such as bHLH, MYB and WD-repeat proteins, among which the R2R3 MYB10 is the main activator in strawberry fruit. Here, we show that independent mutations in *MYB10* are behind the natural fruit color variation observed in diploid woodland strawberry (*F. vesca*) and octoploid cultivated strawberry (*F. × ananassa*). Using a mapping-by-sequencing approach, we identified a gypsy-transposon in *MYB10* that truncates the protein and knocks out anthocyanin biosynthesis in a white-fruited *F. vesca* ecotype. Two additional loss-of-function mutations in *MYB10* were identified among geographically diverse white-fruited *F. vesca* ecotypes. Color variation in octoploid *Fragaria* spp was further investigated by genetic and transcriptomic analyses, which revealed that *FaMYB10-2*, one of three *MYB10* homoeologs identified, is the dominant homoeolog and regulates anthocyanin biosynthesis in developing fruit. Furthermore, independent mutations in *MYB10-2* are the underlying cause of natural variation in fruit skin and flesh color in octoploid strawberry. A genome-wide association study in *F. × ananassa* and analysis in other octoploid populations identified two independent polymorphisms in *FaMYB10-2* causing white skin. Flesh pigmentation was associated with the insertion of a CACTA-like transposon (*FaEnSpm-2*) in the *MYB10-2* promoter and with enhanced *MYB10* expression. Our findings suggest that cis-regulatory elements provided by *FaEnSpm-2* are responsible for ectopic *MYB10-2* expression and anthocyanin biosynthesis in strawberry fruit flesh. We have developed independent molecular marker assays to predict skin and flesh fruit color. Our results show that *MYB10* exerts a simple genetic control over strawberry skin and flesh color, making it a good target for molecular breeding.

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