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Tomato (*Solanum lycopersicum*) homologs of TRIPTYCHON (SlTRY) and GLABRA3 (SlGL3) are involved in anthocyanin accumulation

Rumi Tominaga-Wada,* Yuka Nukumizu and Takuji Wada

Interdisciplinary Research Organization; University of Miyazaki; Miyazaki, Japan

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In *Arabidopsis thaliana* the CPC-like MYB transcription factors [CAPRICE (CPC), TRIPTYCHON (TRY), ENHANCER OF TRY AND CPC 1, 2, 3/CPC-LIKE MYB 3 (ETC1, ETC2, ETC3/CPL3), TRICHOMELESS 1, 2/CPC-LIKE MYB 4 (TCL1, TCL2/CPL4)] and the bHLH transcription factors [GLABRA3 (GL3) and ENHANCER OF GLABRA 3 (EGL3)] are central regulators of trichome initiation and root-hair differentiation. By transforming the tomato orthologous genes *SlTRY* (*TRY*) and *SlGL3* (*GL3*) into *Arabidopsis*, we demonstrated that *SlTRY* inhibited trichome initiation and enhanced root-hair differentiation. These results suggest that tomato and *Arabidopsis* partially use similar transcription factors for epidermal cell differentiation, and that a CPC-like R3 MYB may be a key common regulator of plant trichome and root-hair development. CPC and GL3 are also known to be involved in anthocyanin biosynthesis. Here, we show that anthocyanin accumulation was repressed in the *CPC::SlTRY* and *GL3::SlGL3* transgenic plants, suggesting that *SlTRY* and *SlGL3* can influence anthocyanin pigment synthesis.

The differentiation of plant epidermal cells into trichomes and root hairs has proven to be a very useful paradigm for investigating early events in plant cell development. In *Arabidopsis thaliana*, the *CAPRICE* (*CPC*) gene, a member of the R3-type MYB transcription factor family, is an important regulatory factor for trichome initiation and root hair formation.[1] Genes closely related to *CPC* in the Arabidopsis genome include: *TRYPTICHON*, *TRY*; *ENHANCER OF TRY AND CPC1*, *ETC1*; *ENHANCER OF TRY AND CPC2*, *ETC2*; *ENHANCER OF TRY AND CPC3/CPC-LIKE MYB3, ETC3/CPL3*; *TRICHOMELESS1*, *TCL1* and *TRICHOMELESS2/CPC-LIKE MYB4*, *TCL2/CPL4*.[2-10] The TRY protein functions primarily during trichome initiation.[2,11] Another type of transcription factor in *Arabidopsis*, the bHLH transcription factor GLABRA3 (GL3), also controls trichome initiation and root hair formation.[12] Previously, we reported that the CPC, TRY, ETC1, ETC2 and CPL3 proteins interact with GL3 in yeast and might function together as a transcription factor complex.[7]

Recently, we identified tomato *SlTRY* and *SlGL3* genes as orthologs of the *Arabidopsis TRY* and *GL3* genes, respectively.[13] The *CPCp*::*SlTRY* transgenic plants produced more root hairs and had no trichomes, a phenotype analogous to that of the *35S*::*CPC* transgenic plants.[13] In contrast, *GL3p*::*SlGL3* transgenic plants closely resembled wild-type. These results suggest that *Arabidopsis* and tomato have orthologous transcription factors for epidermal cell differentiation including trichome initiation and root-hair differentiation. Furthermore, *SlTRY*-like R3 MYB appears to function as an important common transcription factor for both trichome initiation and root-hair differentiation.[13]

In addition to epidermal cell differentiation, *Arabidopsis CPC* and *GL3* genes are known to regulate anthocyanin biosynthesis.[14,15] To verify that tomato *SlTRY* and *SlGL3* also play roles in anthocyanin accumulation, we measured the anthocyanin content of *SlTRY* and *SlGL3* transgenic plants. Total plant pigments were extracted from leaves, and anthocyanin levels were measured according to previously reported protocols.[16,17] Compared with the wild-type Col-0, the *CPC::SlTRY* transgenic plants had significantly reduced levels of anthocyanin accumulation (**Fig. 1A**). Compared with the *cpc-2* mutant, *cpc-2* transgenic plants transformed with *CPC::SlTRY* also accumulated significantly less anthocyanin (**Fig. 1A**). Anthocyanin accumulation was somewhat reduced in the *GL3::SlGL3* transgenic plants compared with wild type Col-0 (**Fig. 1B**). In comparison with *gl3-7454* mutants, *gl3-7454* transgenic plants transformed with *GL3::SlGL3* also had significantly lower levels of anthocyanin accumulation (**Fig. 1B**). Therefore, the tomato homologs to the *TRY* and *GL3* genes, *SlTRY* and *SlGL3*, also function as repressors of anthocyanin accumulation.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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*Correspondence to: Rumi Tominaga-Wada; Email: rtominaga@cc.miyazaki-u.ac.jp

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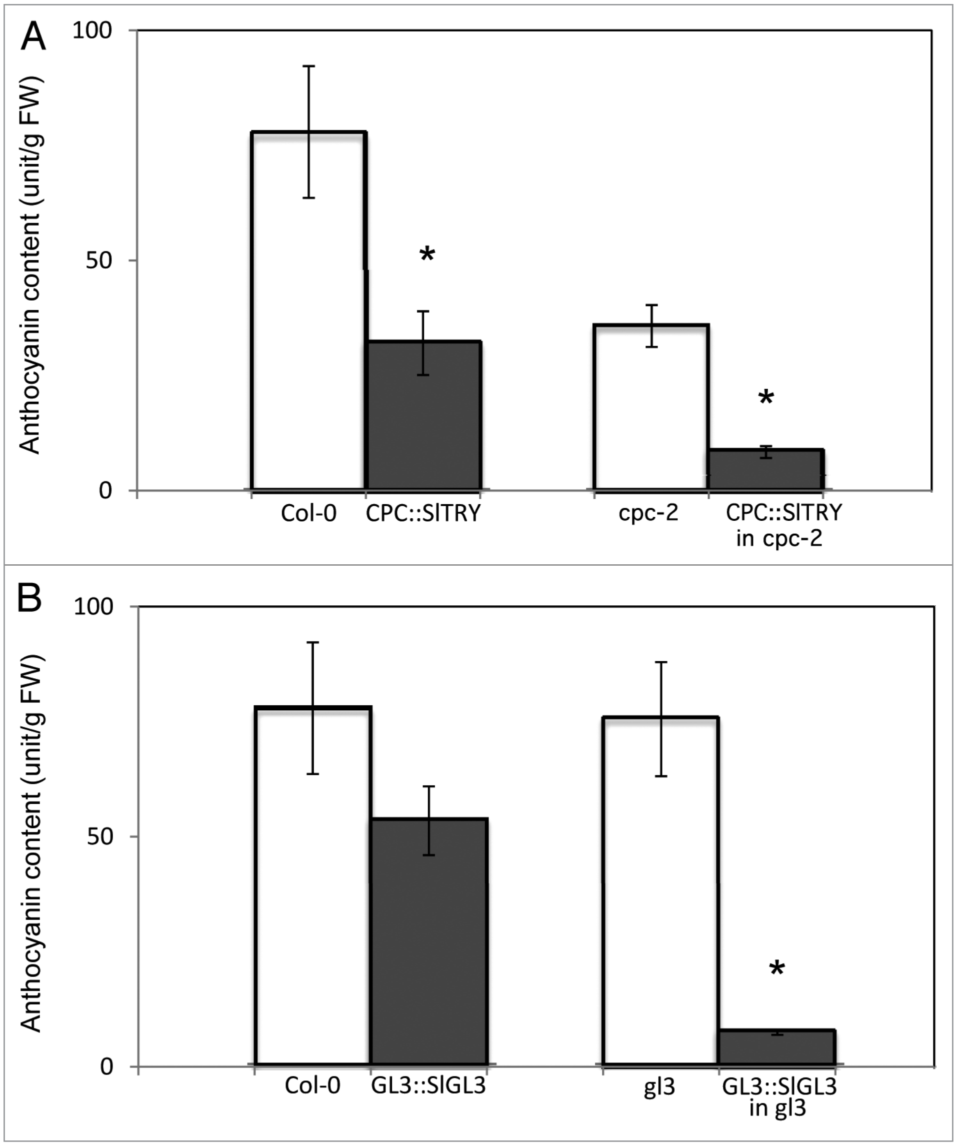

Figure 1. Anthocyanin accumulation is inhibited by *SlTRY* and *SlGL3*. (**A**) Anthocyanin content in wild-type Col-0, *CPC::SlTRY*, *cpc-2* and *CPC::SlTRY* in *cpc-2*. Error bars indicate the standard deviations. Bars marked with asterisks indicate a significant difference between the wild-type Col-0 and the *CPC::SlTRY* transgenic line, or the *cpc-2* mutant and the *CPC::SlTRY* in the *cpc-2* transgenic line by Student's t-test ($p < 0.050$). (**B**) Anthocyanin content in wild-type Col-0, *GL3::SlGL3*, *gl3–7454* and *GL3::SlGL3* in *gl3-7454*. Error bars indicate the standard deviations. Bars marked with asterisks indicate a significant difference between the wild-type Col-0 and the *GL3::SlGL3* transgenic line, or the *gl3-7454* mutant and the *GL3::SlGL3* in *gl3-7454* transgenic line by Student's t-test ($p < 0.050$).

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