

Flavonoids and UV Photoprotection in *Arabidopsis* Mutants

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Wild-type *Arabidopsis* L. leaves exposed to low ultraviolet-B (UVB) conditions contained predominantly kaempferol glycosides, with low levels of quercetin glycosides. The flavonoid level doubled on treatment with UVB and an increase in the ratio of quercetin: kaempferol was observed. These results suggest that flavonols protect *Arabidopsis* plants from UVB damage, and indicate that the flavonoid 3'-hydroxylase (F3'H) enzyme, which converts dihydrokaempferol to dihydroquercetin, may play a crucial role. The *tt7* mutant lacks this gene and, after treatment with sub-ambient UVB, contained kaempferol glycosides exclusively, to a level of total flavonols similar to that in wild-type *Arabidopsis*. Total flavonols after enhanced UVB treatment were higher in *tt7* than in similarly treated wild-type plants, and only kaempferol glycosides were detected. Despite this high level, *tt7* plants were less tolerant of UVB radiation than wild-type plants. These observations suggest that kaempferol is a less effective photoprotectant than quercetin. The chalcone isomerase (CHI) mutant (*tt5*) surprisingly did not accumulate naringenin chalcone, and this suggests that the mutation may not be restricted to the CHI gene alone. The concentration of hydroxycinnamic acid derivatives did not change with UVB treatment in most varieties indicating that their role in UV photoprotection may be subordinate to that of the flavonoids.

Abbreviations: CHI, Chalcone isomerase; CHS, Chalcone synthase; FLS, Flavonol synthase; F3H, Flavanone 3-hydroxylase; F3'H, Flavonoid 3'-hydroxylase; hc, hydroxycinnamic acids; HPLC, High pressure liquid chromatography; Ler, Landsberg *erecta* ecotype; PAL, Phenylalanine ammonia-lyase; RT, retention time; *tt*, transparent testa; Q, quercetin glycosides; K, kaempferol glycosides; Q:K, quercetin to kaempferol ratio; UVA, Ultraviolet-A radiation (320–400 nm); UVB, Ultraviolet-B radiation (280–320 nm); +UVB, enhanced UVB; amb, Ambient UVB; -UVB, low UVB.