

A novel *psbA* mutation (Phe-274-Val) confers resistance to PSII herbicides in wild radish (*Raphanus raphanistrum*)

Huan Lu, Qin Yu, Heping Han, Mechelle J. Owen and Stephen B. Powles
Australian Herbicide Resistance Initiative, School of Agriculture and Environment,
University of Western Australia, Western Australia 6009, Australia
(huan.lu@research.uwa.edu.au)

Summary Wild radish (*Raphanus raphanistrum*) is a globally important weed of crops. Two atrazine-resistant wild radish populations (R1 and R2), collected from the Western Australia grain belt, were investigated for resistance to PSII herbicides. Sequencing of the full-length *psbA* gene revealed a novel Phe-274-Val mutation in population R1, in addition to the well-known Ser-264-Gly mutation in population R2. Herbicide dose-response studies confirmed that the population with the novel Phe-274-Val mutation exhibited modest level of resistance to atrazine, metribuzin and diuron, but were bromoxynil susceptible. The population with the Ser-264-Gly mutation exhibited high level resistance to atrazine, but super sensitivity

to bromoxynil. Structural modelling of the mutant D1 proteins predicts the Ser-264-Gly mutation endows atrazine resistance by abolishing H-bonds, but confers bromoxynil super sensitivity by enhancing H-bonding. The Phe-274-Val substitution confers resistance to atrazine and diuron by indirectly affecting H-bond formation between the Ser-264 residue and the herbicides. The results demonstrate that the Phe-274-Val mutation is likely responsible for resistance to PSII-inhibiting triazine and urea herbicides. To our knowledge, this is the first evidence of the *psbA* Phe-274-Val mutation in higher plants conferring resistance to PSII herbicides.

Keywords PSII herbicide, wild radish, *psbA* gene mutation, D1 protein.