Alterations in the 5’ untranslated region of the EPSPS gene influence EPSPS over-expression in glyphosate-resistant Eleusine indica

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Summary The herbicide glyphosate inhibits the enzyme 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS). Over-expression of the EPSPS gene is one of the molecular mechanisms conferring glyphosate resistance in weeds, but the transcriptional regulation of this gene is poorly understood. The EPSPS gene was found to be significantly up-regulated following glyphosate treatment in a glyphosate-resistant Eleusine indica population from South China. To further investigate the regulation of EPSPS over-expression, the promoter of the EPSPS gene from this E. indica population was cloned and analysed. Two upstream regulatory sequences, Epro-S (862 bp) and Epro-R (877 bp) of EPSPS were obtained respectively from glyphosate-susceptible and resistant E. indica plants by HiTAIL-PCR. The Epro-S and Epro-R sequences were 99% homologous, except for the two insertions (3 bp and 12 bp) in the Epro-R sequence. The 12-base insertion of the Epro-R sequence was located in the 5’-UTR-Py-rich stretch element. The promoter activity tests showed that the 12-base insertion resulted in significant enhancement of the Epro-R promoter activity, whereas the 3-base insertion had little effect on Epro-R promoter activity.

In conclusion, alterations in the 5’-UTR-Py-rich stretch element of EPSPS are responsible for glyphosate-induced EPSPS over-expression. Therefore, EPSPS transcriptional regulation conferred glyphosate resistance in this E. indica population.

Keywords Eleusine indica, EPSPS, promoter, 5’-UTR-Py-rich stretch element, insertion.