Title : Molecular mechanisms underlying non–target-site resistance to auxin herbicides in barnyard grass.

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ABSTRACT

Barnyard grass (Echinochloa crus-galli), one of the most problematic weeds in rice production worldwide, has evolved resistance to quinclorac, an auxin herbicide widely used for its control. Non–target-site resistance (NTSR), particularly metabolic resistance mediated by cytochrome P450 monooxygenases, is increasingly recognized as a key mechanism reducing herbicide efficacy and contributing to multiple herbicide resistance. This study investigated quinclorac resistance in 40 barnyard grass populations collected from major rice-growing area of Thailand and examined the resistant mechanism at molecular level. Seedlings were screened for quinclorac sensitivity using root treatment by herbicide mixture in Murashige & Skoog (MS) medium under sterile conditions. The sensitive population (MK-2D) showed complete growth inhibition at 0.01x recommended label rate of quinclorac, whereas resistant populations survived and continued growing. To evaluate multiple resistance, twenty herbicides in different modes of action were tested in the resistant populations. The results showed that PB1 and AY2 populations exhibited multiple-herbicide resistance indicating NTSR mechanism might confer resistance. To determine the involvement of metabolic resistance, malathion, a known cytochrome P450 inhibitor, was applied prior to quinclorac treatment in selected populations. Malathion pre-treatment restored

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quinclorac susceptibility in line R511, the quinclorac resistant line expressing high P450 level. Transcriptome analysis is being performed to elucidate all up-regulated genes involving in NTSR mechanism in these populations. Overall, quinclorac resistance in Thai barnyard grass is associated with multiple-herbicide resistance and might involve P450–based metabolic mechanisms. This research provides important implications for sustainable herbicide resistance management in rice production systems.

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