Title : Physiological Responses of Quinclorac-Resistant *Echinochloa crus-galli*

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ABSTRACT

Herbicide resistance poses a significant challenge to weed management in agricultural systems. This study elucidates the physiological mechanisms associated with quinclorac resistance in *Echinochloa crus-galli* (barnyard grass) by comparing two resistant populations (NN1, AY1) with a susceptible population (2-CM10). Dose-response assays were conducted to evaluate quinclorac efficacy by growing seedlings in herbicide-supplemented, half-strength Murashige and Skoog (MS) solid medium. Seedling growth was monitored over nine days to construct dose-response curves. Concurrently, the role of cytochrome P450-mediated detoxification was examined through co-treatment with quinclorac and malathion, a known P450 enzyme inhibitor. The effects of quinclorac on ethylene biosynthesis were further investigated using gas chromatography, with ethylene production quantified at 24-hour intervals following treatment. Results indicate that resistant populations (NN1 and AY1) maintained growth under quinclorac exposure, whereas the susceptible population (2-CM10) exhibited significant growth inhibition ($p < 0.05$). Furthermore, malathion application failed to reverse resistance in NN1 and AY1, suggesting that non-P450 mechanisms predominate in quinclorac detoxification. Preliminary ethylene biosynthesis analyses revealed distinct responses between resistant and susceptible populations, indicating that resistance may involve modifications in ethylene signaling pathways. While further investigations into ethylene dynamics are ongoing, current findings suggest that quinclorac resistance in *E. crus-galli* is mediated by multifaceted physiological adaptations beyond P450 metabolism, potentially including altered ethylene regulation. This study provides new insights into the complexity of herbicide resistance and underscores the necessity of integrated weed management strategies. These findings establish a foundation for molecular studies on resistance mechanisms and inform the development of targeted

approaches, such as enzyme inhibition or ethylene pathway modulation, to mitigate herbicide resistance in agricultural systems.