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Assessing root and shoot traits associated with herbicide resistance in weeds

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As the incidences of herbicide resistance in weeds continue to worsen, the necessity to screen weed samples for herbicide resistance has become more important. Numerous techniques have evolved that can confirm herbicide resistance in weed species. However, most of these techniques either take long to complete (3-5 weeks), or lack strong association of shoot and root traits with herbicide resistance. In this study, we used annual bluegrass as a model weed to demonstrate rapid root and shoot phenotyping for herbicide resistance. Acetolactate synthase (ALS) inhibitors are most commonly used for control of annual bluegrass. However, repeated usage of these herbicides has resulted in resistance reported in Alabama, Tennessee, and Mississippi. The objectives of this study is to develop a rapid Murashige and Skoog (MS) plate assay for herbicide resistant trait, which can then be used for confirming resistance of any annual bluegrass sample from residential or commercial turfgrass, in less than two weeks. Greenhouse dose response studies revealed resistant population (Reunion) to be 45 times more resistant to foramsulfuron than the susceptible annual bluegrass population (commercially purchased). The resistant population requires 331 g of foramsulfuron ha-1, whereas the susceptible population only requires 7.2 g of foramsulfuron ha-1, to achieve 50% control. For the plate assay, plants were grown in MS medium, and three inoculation techniques were tested. The seed and root tip inoculation proved to be the most effective in discriminating between resistant and susceptible population. Total time involved from planting of seed to confirming resistance was about 2 weeks. Daily non-destructive root scans were able to identify changes in root characteristics (number of laterals, root length, root area, and root growth rate) between resistant and susceptible population. This plate assay can potentially be used with any weed species to effectively detect resistance trait, and can be combined with molecular assays to further confirm resistance.

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Pollen tube guidance: The interplay between male and female gametophytes

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During evolution, novel reproductive structures and mechanisms have been emerged in plants. In angiosperms, such evolutionary development is manifested by the flower, multicellular gametophyte, double fertilization, loss of sperm motility, and siphonogamy in which the immotile sperm was delivered to the egg by a pollen tube produced by the male gametophyte (pollen), a process named pollen tube guidance (PTG). Previous studies suggested that PTG requires the intimate interactions between the pollen tube and maternal tissue of the pistil and the female gametophyte respectively. Through genetic screen, we isolated a number of Arabidopsis mutants that disrupt these processes. *CCG*, a central cell-specifically expressed gene, is required for the female gametophyte to attract the pollen tube. *CCG* encodes a nuclear protein that regulates the expression of a number of genes important for PTG via interacting with RNA polymerase II, the Mediator complex and AGL transcription factors. *POD1*, a pollen tube-expressed gene, is required for the male gametophyte to respond to the female signals. *POD1* encodes a ER protein that interact specifically with CRT3, suggesting that it might play a role in the protein folding of putative receptor proteins. Recently, we identified the male MDIS/MDIK receptor complex that recognizes the female attracting signals. These findings provide novel insight to mechanims controlling PTG and more recent progresses will be discussed.

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