PROGRESS TOWARDS UNDERSTANDING THE MECHANISM OF PPO INHIBITOR RESISTANCE IN WATERHEMP. William L. Patzoldt, Aaron G. Hager, Joel S. McCormick, and Patrick J. Tranel, Graduate Research Assistant, Assistant Professor, Undergraduate Research Assistant, and Associate Professor, Department of Crop Sciences, University of Illinois, Urbana, IL 61801.

In 2001, a waterhemp population with resistance to protoporphyrinogen oxidase (PPO)-inhibiting herbicides was identified in Adams County, Illinois. Crosses were conducted among plants from a line derived the Adams County, IL waterhemp population that were uniformly resistant to PPO inhibitors (R parent) and a waterhemp biotype that were susceptible to PPO inhibitors (S parent) to create F_1 lines. F_1 plants were crossed among themselves to generate F_2 lines, or to plants from the R or S parental biotype to create backcrossed (BC) progeny. Following treatment of F_2 and BC progeny with lactofen at 110 g ai ha^{-1} plus 1% (by vol) COC, segregation of resistant and susceptible responses suggested that PPO inhibitor resistance was inherited as a single nuclear gene. Herbicide dose-response experiments with F_1 progeny, when compared with R and S parents, suggested that resistance to either lactofen or acifluorfen was incompletely dominant. The genes encoding both the plastid and mitochondrial PPO isozymes, *PPX1* and *PPX2*, respectively, were sequenced and compared from multiple plants of R and S parental biotypes. Interestingly, *PPX2* was identified in two isoforms, a short form (*PPX2S*) whose translation product encodes a mitochondrial PPO, and a long form (*PPX2L*) whose translation product encodes a mitochondrial PPO with a chloroplastic transit peptide sequence. PCR-based molecular markers were developed capable of identifying *PPX* alleles from either the R or S parental biotypes in segregating waterhemp lines. The *PPX* allele-specific PCR markers are being used to determine if *PPX1* or *PPX2L* correlate with resistant and susceptible lactofen responses in BC progeny.

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