GLYPHOSATE RESISTANCE IN WATERHEMP: INHERITANCE AND EPSPS COPY NUMBER.
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The inheritance of glyphosate resistance was investigated in a glyphosate-resistant (R) waterhemp population (MO1) from Missouri. The MO1 population was crossed with a glyphosate-susceptible (S) population (ACR) to create $F_1$s. Reciprocal crosses were utilized to determine whether glyphosate resistance was maternally or nuclear inherited. $F_1$ lines were screened with glyphosate in the greenhouse, and a range of phenotypes from R to S were observed, with no apparent dependence on the direction of the cross. Thus, glyphosate resistance appears to be a nuclear inherited trait. $F_2$s were created by crossing $F_1$ plants, and $F_2$ lines were screened for glyphosate resistance. Again, a range of phenotypes from R to S were observed in these $F_2$ lines. $BC_s$ lines were also created by crossing $F_1$ plants with ACR, with reciprocal crosses again utilized. The progeny were screened with glyphosate and demonstrated a range of phenotypes from intermediate to S. An attempt was also made to create a homozygous glyphosate-resistant line by utilizing clones. Cloning of plants enabled multiple crosses for each plant, including a testcross to the S biotype. Screening of testcross progeny for glyphosate resistance potentially could enable discrimination of homozygous from heterozygous parents. Unexpectedly, however, testcross progeny did not exhibit segregation ratios consistent with glyphosate resistance being a single gene trait. Based on experiments conducted on palmer amaranth showing that R palmer contained up to an 80-fold increase in EPSPS copy number, qPCR was performed on waterhemp from the $F_1$, $F_2$ and MO1 lines to test whether the same resistance mechanism was present in waterhemp. MO1 showed a four-fold increase in EPSPS copy number as compared with ACR. Investigation of $F_1$s revealed a range of copy number from that of ACR to even more than that of MO1. Preliminary results suggest that increased copy number alone does not necessarily confer resistance to glyphosate. All resistant plants had increased copy number, but not all plants with increased copy number were resistant. This indicates that, in addition to increased EPSPS copy number, another factor is necessary to confer glyphosate resistance.

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