Powles Plain English

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Colleagues,

As you are aware, many weed species have evolved resistance to ALS herbicides in many parts of the world. In Australia, ALS herbicide resistance evolution has been rapid and widespread in Lolium rigidum and Raphanus raphanistrum.

Evaluating the effect of resistance endowing gene mutations on plant fitness is challenging because for unequivocal results it is necessary to work with plants with a well characterised resistance mechanism, work with plants homozygous for the resistance trait, minimise genetic differences between resistant (R) and susceptible (S) populations and conduct experiments under competition. We were able to meet most of these criteria working with ALS herbicide resistant Raphanus populations.

In this just published work, ALS herbicide resistant Raphanus populations were purified as individually homozygous for the specific ALS gene resistance endowing mutations:

- Ala-122-Tyr
- Pro-197-Ser
- Asp-376-Glu
- Trp-574-Leu

In this work with these homozygous ALS herbicide resistant Raphanus populations these four ALS gene resistance endowing mutations did NOT adversely impact plant fitness, in the presence or absence of competition. Similarly, previously we found in ALS herbicide resistant Lolium that various Pro-197 mutations or Trp-574-Leu also did not impact plant fitness (Yu et al 2010, Jnl. Exp Bot (attached). Therefore, at least for the ALS herbicide resistant Raphanus raphanistrum and Lolium rigidum populations that we have studied, certain ALS resistance endowing gene mutations do NOT adversely impact plant fitness.

This data certainly helps explain that certain ALS resistance gene frequencies are initially high and resistance evolution to ALS herbicides occurs rapidly. The absence of a fitness penalty for many ALS gene resistance endowing mutations is certainly a contributing factor to the rapid evolution of ALS herbicide resistance that has occurred in weed species around the world.

Thank you,

Stephen Powles, FAA, FTSE
Winthrop Professor,
Director, Australian Herbicide Resistance Initiative
T: 08 6488 7833, E: stephen.powles@uwa.edu.au
(M086) The University of Western Australia