

Resistance to hormone mimic herbicides and acetohydroxyacid synthase-inhibiting herbicides in *Sisymbrium orientale*

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Summary *Sisymbrium orientale* L. (Indian hedge mustard) is an important broadleaf weed of cereal cropping in South Australia. *S. orientale* is readily controlled by the sulfonylurea herbicides that inhibit acetolactate synthase (ALS). Extensive use of these herbicides has resulted in widespread resistance in this weed in South Australia. To control ALS herbicide-resistant *S. orientale*, farmers have reverted to the hormone mimic herbicides 2,4-D and MCPA.

In 2005, failure of 2,4-D to control *S. orientale* was reported in a wheat field near Port Broughton, South Australia. Dose response experiments were conducted with hormone-mimic herbicides, AHAS-inhibiting herbicides and the phytoene desaturase inhibiting herbicide diflufenican.

In these dose response experiments the resistant population proved to be resistant to 2,4-D and MCPA. It was also resistant to the AHAS-inhibiting herbicides metsulfuron-methyl, chlorsulfuron, imazethapyr, metosulam and florasulam. The resistant population could be controlled by diflufenican. When compared to two susceptible populations, the resistant population was 20-fold resistant to 2,4-D and MCPA. The resistant population was more than 500-fold resistant to chlorsulfuron, more than 400-fold resistant to metosulam, 32-fold resistant to metsulfuron-methyl, 23-fold resistant to florasulam and 4-fold resistant to imazethapyr.

The 2,4-D-resistant and susceptible plants were crossed by hand. The seed produced on the susceptible

plants was screened with 200 g a.e. ha⁻¹ 2,4-D to identify potential crosses. These plants were selfed and the progeny screened with 200 g a.i. ha⁻¹ 2,4-D to determine the inheritance of resistance to 2,4-D. Resistance to 2,4-D was inherited as a dominant gene meaning it can spread in both pollen and seed.

An experiment to detect possible gene flow between 2,4-D resistant and susceptible plants. A single resistant and a single susceptible plant were placed together outdoors at least 15 m from any other *S. orientale* plants. Seed was collected from the susceptible plant of each pair, germinated and screened with 200 g a.i. ha⁻¹ 2,4-D to detect possible hybrids. Less than 1% of seedlings from the susceptible plants survived this treatment, suggesting levels of pollen mediated gene flow are low in this species. These plants were selfed and the progeny will be examined to determine whether these survivors were hybrids.

Resistance to hormone mimic herbicides has evolved only slowly in weeds around the world, but has the potential to greatly reduce the options for the control of broadleaf weeds. The evolution of resistance to hormone mimic herbicides in *S. orientale* is particularly problematic as the evolution of resistance to both hormone mimic and ALS-inhibiting herbicides in the same population means weed control will be more difficult and more expensive.

Keywords *Sisymbrium orientale*, 2,4-D, MCPA, imazethapyr, metosulam, metsulfuron-methyl, herbicide resistance.