



Mutations associated with QoI-resistance

Three amino acid substitutions have been detected in the cytochrome b gene in plant pathogens that govern resistance to Qo Inhibitors:

- Change from glycine to alanine at position 143 (G143A)
- Change from phenylalanine to leucine at position 129 (F129L)
- Change from glycine to arginine at position 137 (G137R)

All G143A, G137R and F129L are based on single nucleotide polymorphisms in the cytochrome b gene; the selection process is qualitative (single step).

Based on current knowledge, resistance factors (RF = ED50* [resistant strain] / ED50 [sensitive wild-type strain]) associated with G143A, G137R and F129L are different. RF's caused by F129L and G137R usually range between 5 -15, and in a very few cases up to 50, whilst resistance factors related to G143A are in most cases greater than 100 and usually greater than several hundreds. Isolates carrying G143A express high (complete) resistance. Isolates with F129L or G137R express moderate (partial) resistance. QoIs applied at manufacturers' recommended rates are shown to provide effective control of diseases with the F129L or G137R mutation. In contrast, a severe loss in disease control is always seen in populations where G143A predominates and QoIs are used alone.

G143A has been shown to be responsible for QoI resistance in more pathogen species than F129L (19 out of 25 plant pathogens carry G143A). F129L has been detected in 3 out of 25 plant pathogens, and 3 out of 25 pathogens possessing both mutations. G137R has been found only in *Pyrenophora tritici-repentis*, at very low frequency.

*ED50: Effective dose with 50% response (inhibition)

References

Degli Esposti M, de Vries S, Crimi M, Ghelli A, Patarnello T, and Meyer A. Mitochondrial cytochrome b: Evolution and structure of the protein. *Biochim. Biophys. Acta* 1993; 1143: 243-271.

Gisi U, Pavic L, Stanger C, Hugelshofer U, and Sierotzki H. Dynamics of *Mycosphaerella graminicola* Populations in Response to Selection by Different Fungicides. In Dehne HW, Gisi U, Kuck KH, Russell PE, and Lyr H, editors. *Modern fungicides and antifungal compounds IV*; 14th International Reinhardsbrunn Symposium, Friedrichroda, Thuringia, Germany, April 25-29, 2004. British Crop Protection Council; 2005. p. 89-101.

Gisi U, Sierotzki H, Cook A, McCaffery A. Mechanisms influencing the evolution to Qo inhibitor fungicides. *Pest Management Science* 2002; 58: 859-867.

Kim YS, Dixon P, Vincelli P, Farman ML. Field resistance to strobilurin (QoI) fungicides in *Pyricularia grisea* caused by mutations in the mitochondrial cytochrome b gene. *Phytopathology* 2002; 93: 891-900.

Pasche JS, Wharam CM, Gudmestad NC. Shift in sensitivity of *Alternaria solani* (potato early blight) to strobilurin fungicides. In *The BCPC Conference: Pests and diseases, Volumes 1 and 2. Proceedings of an international conference held at the Brighton Hilton Metropole Hotel, Brighton, UK, 18-21 November 2002.* British Crop Protection Council; 2002. p. 841-846.

Rosenzweig N, Olaya G, Atallah ZK, Cleere S, Stanger C, Stevenson WR. Statewide monitoring and tracking changes in sensitivity to azoxystrobin fungicide in *Alternaria solani* in Wisconsin. *Plant Disease* 2008; 92: 555-560.

Sierotzki H, Wullschleger J, Gisi U. Point-mutation in cytochrome b gene conferring resistance to strobilurin fungicides in *Erysiphe graminis f. sp. tritici* field isolates. *Pesticide Biochemistry and Physiology* 2000; 68: 107-112.

Sierotzki H, Parisi S, Steinfeld U, Tenzer I, Poirey S, Gisi U. Mode of resistance to respiration inhibitors at the cytochrome bc1 complex of *Mycosphaerella fijiensis*. *Pest Management Science* 2000; 56: 833-841.

Sierotzki H, Frey R, Wullschleger J, Palermo S, Karli S, Godwin J, Gisi U. Cytochrome b gene sequence and structure of *Pyrenophora teres* and *P. tritici-repentis* and implications for QoI resistance. *Pest Management Science* 2006; 63: 225-233.

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