

RESISTANCE TO THE SDHI FUNGICIDES BOSCALID, FLUOPYRAM, FLUXAPYROXAD, AND PENTHIOPYRAD IN *Botrytis cinerea* FROM COMMERCIAL STRAWBERRY FIELDS IN SPAIN

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Gray mold, caused by the necrotrophic fungus *Botrytis cinerea* Pers., is one of the most economically important diseases of strawberries. Gray mold control involves the application of fungicides throughout the strawberry growing season; however, *B. cinerea* isolates resistant to multiple classes of site-specific fungicides have been recently reported in the Spanish gray mold population. Succinate dehydrogenase inhibitors (SDHIs) constitute a relatively novel class of fungicides registered for gray mold control representing new alternatives for strawberry growers. In the present study, 37 *B. cinerea* isolates previously characterized for their sensitivity to boscalid and amino acid changes in the SdhB protein were used to determine the effective concentration that reduces mycelial growth by 50% (EC₅₀) to fluopyram, fluxapyroxad and penthiopyrad. The present study was also conducted to obtain discriminatory doses to monitor SDHI fungicide resistance in 580 *B. cinerea* isolates collected from 27 commercial fields in Spain during 2014, 2015, and 2016. The EC₅₀ values ranged from 0.01 to >100 µg/ml for fluopyram, from <0.01 to 4.19 µg/ml for fluxapyroxad, and finally, from <0.01 to 59.65 µg/ml for penthiopyrad. Based on these results, as well as findings from a previous publication, the discriminatory doses chosen to examine sensitivities to boscalid, fluopyram, fluxapyroxad, and penthiopyrad were 100, 15, 1, and 6 µg/ml, respectively. Over the course of the three-year monitoring period, the overall frequencies of resistance to the four SDHIs were 56.9, 6.9, 12.9, and 24.6%, respectively. Four SDHI resistance patterns were observed in our population, which include patterns I (30%; resistance to boscalid), II (13.8%; resistance to boscalid and penthiopyrad), III (5.7%; boscalid, fluxapyroxad, and penthiopyrad) and IV (7.9%; resistance to boscalid, fluopyram, fluxapyroxad and penthiopyrad). Patterns I and II were associated with the amino acid substitutions H272R/Y; pattern III was associated only with the H272Y mutation; and finally, pattern IV was associated with the N230I allele in the SdhB subunit. For gray mold management, it is suggested that the simultaneous use of boscalid and penthiopyrad should be limited to one application per season; however, the use of fluxapyroxad and, especially, fluopyram could be used as valid SDHI alternatives for gray mold control, but they should be applied with caution.

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