

Resistance of Insects to Neonicotinoids: Current Status and Future Prospects

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The first neonicotinoid insecticide introduced to the market was imidacloprid in 1991 followed by several others belonging to the same chemical class and with the same mode of action. The development of neonicotinoid insecticides has provided growers with invaluable new tools for managing some of the world's most destructive crop pests, primarily those of the order Hemiptera (aphids, whiteflies and planthoppers) and Coleoptera (beetles) – including species with a long history of resistance to earlier-used products. To date, neonicotinoids have proved relatively resilient to the development of resistance, especially when considering aphids such as *Myzus persicae* and *Phorodon humuli*. Although the susceptibility of *M. persicae* may vary up to 20-fold between populations, this does not appear to compromise the field performance of neonicotinoids. Stronger resistance has been confirmed in some populations of the whitefly, *Bemisia tabaci*, and the Colorado potato beetle, *Leptinotarsa decemlineata*. Resistance in B- and Q-type *B. tabaci* appears to be linked to enhanced oxidative detoxification of neonicotinoids due to overexpression of monooxygenases. No evidence for target-site resistance has been found in whiteflies, whereas the possibility of target-site resistance in *L. decemlineata* is being investigated further. Strategies to combat neonicotinoid resistance must take account of the cross-

resistance characteristics of these mechanisms, the ecology of target pests on different host plants, and the implications of increasing diversification of the neonicotinoid market due to a continuing introduction of new molecules.