SCIENTIFIC NOTE

# AN INCREASE IN SPINOSAD RESISTANCE DETECTED IN AUSTRALIAN *FRANKLINIELLA OCCIDENTALIS* (PERGANDE)(THRIPIDAE: THYSANOPTERA)

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**Summary**

In Australia spinosad is the mainstay insecticide for western flower thrips *Frankliniella occidentalis* (Pergande) control. Spinosad resistance was first detected in the 2002/2003 season from when it progressively increased to plateau at 100 to 200-fold. In season 2010/2011 a population of *F. occidentalis* collected from ornamental plants (*Chrysanthemum* sp.) was found to be 1400-fold resistant to spinosad indicating a magnitude increase in resistance. This is the highest level spinosad resistance yet detected in Australian *F. occidentalis*.

**Keywords:** Success™ Naturalyte™

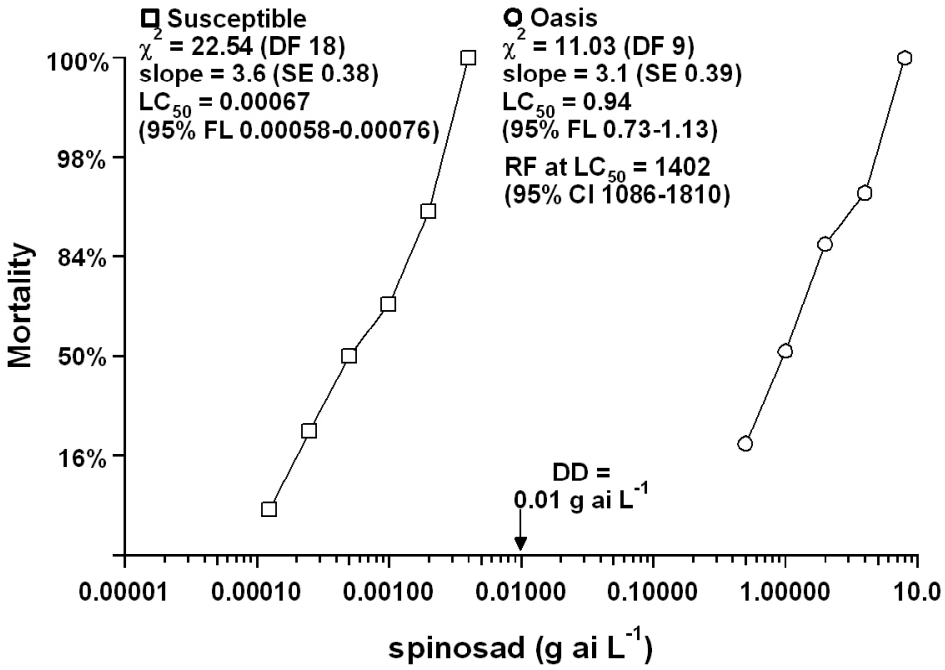
In Australia, *F. occidentalis* is largely controlled with the insecticide spinosad (InfoPest 2010). Spinosad was first registered for use in Australia in October 1997 (APVMA 2011) and is currently available to control *F. occidentalis* on some 68 host crops (InfoPest 2010). Unlike the organophosphate or carbamate alternatives, spinosad is considered IPM compatible (Jones *et al*., 2005) making long term product efficacy desirable for IPM based *F. occidentalis* management.

A low 1.8-fold spinosad resistance was detected in a single population of *F. occidentalis* collected from lettuce during the 2002/2003 growing season (Herron and James 2005). The following season (2003/2004) resistance to spinosad in field-collected populations of *F. occidentalis* remained relatively static at 2.6-fold. Unfortunately, resistance in field-collected populations started to dramatically increase during the 2004/2005 season, to a maximum of 40-fold resistance. That increased again to 87-fold by season 2005/2006 (Herron and James 2007). Resistance peaked at 201-fold in season 2006/2007 and did not exceed 156-fold in 2008/2009 (Herron *et al*. 2010). Such levels of spinosad resistance in Australian *F. occidentalis* are in stark contrast to the Spanish laboratory study of Bielza *et al*. (2008) that documented >23000-fold. In season 2010/2011 a strain of *F. occidentalis* associated with high spinosad use and control failure was forwarded for testing. The strain known as Oasis was collected off *Chrysanthemum* sp. in a nursery from the Winmalee district of NSW.

*F. occidentalis* were cultured on potted dwarf French bean (*Phaeseolus vulgaris* Linnaeus) using methods detailed in Herron and Gullick (2001). The bioassay procedure used was that detailed in Herron *et al*. (1996). Anaesthetised *F. occidentalis* were tipped onto French bean-leaf discs embedded in agar in small Petri dishes and were then sprayed with aqueous serial concentrations of insecticide (4 mL aliquot) or with water (control) via a Potter spray tower (deposit of 3.2 mg $cm^{-2}$). The Petri dishes were covered with taut plastic cling-wrap film perforated with 40-50 fine holes and were stored at 25 ± 0.1 $^{o}$C in an 18:6 hour L: D regimen. After 48 h the numbers of alive and dead thrips were counted. Each test was replicated at least once. Control mortality did not exceed 15%. Probit analyses of the data corrected for control mortality (Abbott 1925) provided estimates of $LC_{50}$ level resistance factors (Barchia 2001) and their associated 95% confidence intervals (CI) Roberston *et al*. (2007).

Spinosad resistance in strain ‘Oasis’ was measured at 1402 (95% CI 1086-1810) -fold (Figure 1). This is an order of magnitude increase over the levels reported in 2006/2007 by Herron et al. (2010). It is noteworthy that prior to 2006/2007 results of discriminating dose bioassays suggested that some populations were comprised of close to 100% resistant individuals (Herron *et al*. 2010). With no increase in the phenotypic frequency of resistant individuals the new level of resistance may indicate over expression of the resistance mechanism, multiple resistance mechanisms or an interaction between several mechanisms. Multiple resistance mechanisms are considered likely as fipronil resistance in Australian *F. occidentalis* was initially found to be independent of spinosad resistance (Herron and James 2005) yet the Oasis strain is both spinosad and fipronil (235-fold (157-351)) resistant (unpub. data) despite fipronil having been used only once.

Figure 1. Probit regressions (□ Susceptible and ○ Oasis resistant) against *Frankliniella occidentalis* giving slope value (± standard error SE), $\chi^2$ (with degrees of freedom DF), $LC_{50}$ (with 95% fiducial limits FL) and resistance factor RF at the $LC_{50}$ level (with 95 % confidence interval CI).

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