Short Communication

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Toxicity of Endosulfan to Adult *Aphytis melinus* De Bach (Hymenoptera: Aphelinidae)

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Aphytis melinus De Bach is a major biological control agent of citrus red scale, *Aonidiella aurantii* (Maskell) (Homoptera: Diaspididae) in Australia and in many other citrus growing regions of the world [1]. Although the degree of control provided by *A. melinus* ranges from partial to complete in different citrus growing areas, its effectiveness is severely impeded by the use of insecticides [2, 3]. In recent years endosulfan as insecticide has been used on citrus in these areas to control spined citrus bug, *Biprorulus bibax* Breddin (Hemiptera: Pentatomidae). The use of this compound in citrus is likely to increase because of its incorporation in an integrated pest management (IPM) program for *B. bibax* based on wasp parasitoids and pheromones [4-6]. The toxicity of 20 pesticides to *A. melinus* was examined [7] and endosulfan shown to be safe to immature stages of the wasp. No assessment was made of direct endosulfan spray toxicity to adult *A. melinus* which are most susceptible to contact pesticides [1]. This laboratory study was conducted to determine the dose/mortality relationship between adult *A. melinus* and endosulfan and to compare this with proposed field rates for *B. bibax* control.

Adult *A. melinus* were obtained from parasitised oleander scale, *Aspidiotus nerii* Bouche, reared on butternut pumpkin. Wasps were held at 22.5° for up to 10 days before bioassay. CO_2 anaesthetised wasps were transfered to disposable plastic cups (30 ml) (25-50 per cup) capped with muslin gauze upon which a drop of undiluted honey was provided. A 350 g/L emulsifiable concentrate formulation of endosulfan was tested against *A. melinus* using a Potter spray tower. Wasp activity was reduced by placing the cups in cool esky (5-10° for 10-15 mins.) which allowed safe removal of lids prior to spraying. Four or five serial dilutions were used and 5 ml of liquid was sprayed onto one cup per concentration. The spraying pressure was 50kPa and provided even coverage of bottom and sides of cups. Once a dose/mortality range was identified the test was replicated 3 times and a water only treatment was included in each replicate as a control. After spraying, the cups were placed at 25° under 15L:9D. Mortality was assessed after 40 hrs. Individuals were considered dead if they were unable to maintain a normal posture or walk normally covering at least 1mm/s. The dose/mortality data were corrected for control mortality [8] and analysed by probit analysis [9].

An LC_{99} (95% F.L) of 48mg/L (53-43 mg/L) and LC_{50} of 12 mg/L (12-11mg/L) were obtained for endosulfan against adult *A. melinus* (slope 3.79 ± 0.44). The current recommended application rate of endosulfan against *B. bibax* in Australia is 57mL/100L or 200mg/L. Although earlier data [7] indicate that immature *A. melinus* would survive this rate, this study suggests that adults would not. Recent studies on the toxicity of endosulfan to adult *B. bibax* indicate that field rates of 8-10mL/100L may be effective (James unpubl. data). This corresponds to a dosage rate of around 28-35 mg/L which based on the bioassay data presented here, is unlikely to kill 100% of *A. melinus* adults.

There are many difficulties in predicting the field performance of pesiticides from laboratory bioassay data. However, laboratory bioassays tend to "over-emphasis" toxicity ratings because factors which may reduce the efficacy of a chemical in the field (e.g. application problems, weathering of residues) do not interfere with the assessment. Therefore, it is likely that a field rate of endosulfan around 35 mg/L would allow some survival of adult *A. melinus*. It is possible that rates of endosulfan near the LC_{50} might have significant sub-lethal effects on longevity, fecundity and sex ratio of *A. melinus* [10].

This study and earlier research [7] indicate that the application of low rates of endosulfan for control of *B. bibax* on citrus is compatible with survival of *A. melinus*. The alternative chemical treatments for *B. bibax*, methidathion and malathion, are not effective at low rates (James unpul. obs.) and are documented as being highly toxic to all stages of *A. melinus* [7,11].

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Key words: Endosulfan, *Aphytis melinus*, Toxicity.

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