

Short Communication

Pak. j. sci. ind. res., vol. 36, no.1, January 1993

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

DAVID G. JAMES

NSW Agriculture, Yanco Agricultural Institute, PMB Yanco,
New South Wales, Australia, 2703

(Received April 8, 1992; revised January 10, 1993)

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. CO₂ anaesthetised wasps were transferred 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 LC₉₉ (95% F.L.) of 48mg/L (53-43 mg/L) and LC₅₀ 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 pesticides 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 LC₅₀ 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 unpubl. obs.) and are documented as being highly toxic to all stages of *A. melinus* [7,11].

Acknowledgements. I thank James Altmann of Biological Services Ltd, Loxton, South Australia for supply of *A. melinus* and Glen Warren and Richard Faulder for technical assistance.

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

References

1. Dr. Rosen, *Armoured Scale Insects, Their Biology, Natural Enemies and Control* (Elsevier: Amsterdam, 1990), Vol. B.
2. P. DeBach, D. Rosen and C. E. Kennett, *Biological Control*, C. B. Huffaker (ed.) (Plenum Publishing

- Corp., New York, 1971).
- 3. T. S. Bellows, J. G. Morse, J. G. Hadjidemetriou and Y. Iwata, *J. Econ. Entomol.*, **78**, 681 (1985).
- 4. D. G. James, *J. Aust. Ent. Soc.*, **27**, 297 (1988).
- 5. D. G. James, *Gen. Appl. Ent.*, **22**, 55 (1990).
- 6. D. G. James and G. N. Warren, *J. Aust. Ent. Soc.*, **28**, 75 (1989).
- 7. R. A. H. Davies and I. W. McLaren, *Aust. J. Exp. Anim. Husb.*, **17**, 323 (1977).
- 8. W. S. Abbott, *J. Econ. Entomol.*, **18**, 265 (1925).
- 9. D. J. Finney, *Probit Analysis* (Cambridge University, London, 1971).
- 10. J. A. Rosenheim and M. A. Hoy, *J. Econ. Entomol.*, **18**, 476 (1988).
- 11. J. A. Rosenheim and M. A. Hoy, *J. Econ. Entomol.*, **79**, 1161 (1986).

(Received December 19, 1991; revised December 30, 1992)

This study reports on processing of single and mixed fruit jams from mango, pineapple, jack-fruit, guava, water-melon and carrot pulp. The fruit and vegetable pulps were analysed for moisture, total soluble solids, total sugar, acidity, ascorbic acid and pH content. Forty eight samples of jams were prepared from single and composite of these fruit and vegetable pulp. Freshly prepared jams were analysed for total soluble solids, acidity and pH and their acceptability was evaluated by a taste panel. The optimum total soluble solids and pH were found around 67.5% and 3.0 respectively. Except watermelon all other fruit and vegetable pulps were suitable for jams preparation. The jams were shelf stable under ambient temperature upto 12 months.

Key words: Fruit and vegetable pulp, Jam, Processing

Introduction

Mango, pineapple, jack-fruit, watermelon, guava and carrot are portable food items. After harvesting these cannot be kept for long unless preserved. Bangladesh does not produce sufficient quantities of these fruits and vegetables to fulfil the requirements. But some of these are available as seasonal surplus. In the year 1987-88, total production of mango, pineapple, jack-fruit, watermelon and guava were 119652, 33390, 234233, 116000 and 25000 metric tons respectively. [1]. These fruits and vegetables are available for 3 - 4 months in a year and during the peak harvesting season, we cheapen to the supply.

Jam is a food made from not less than 45 parts by weight of fruit pulp to each 55 parts by weight of sugar and its microbiological stability depends on acid, high soluble solid levels [2]. It is an important item of product range in fruit processing industry. Soft and hard fruits and vegetables which contain cosmetic defects are able to be processed to good quality jams.

In this study, the use of mango, pineapple, jack-fruit, guava, watermelon and carrot pulps as well as a mixture of these pulps in the preparation of jam was investigated.

Materials and Methods

The experiment was conducted in the Laboratory of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh, Mymensingh (Var. Jakes), Pineapple (Var. Giant Kew), Guava (Local cultivar), Jack-fruit (Local cultivar) Carrot (Local cultivar) and Watermelon (Hybrid) were produced from BAU farm and Mymensingh market.

Extraction of Pulp

Mango: Fully ripe mangoes were washed and peeled. The pulp was extracted from mango by separating between the

ingers and strained by passing through a bamboo sieve. The pulp was pasteurized at 80-85°C for 10 mins, packed in a polyethylene bag and stored.

Pineapple: The crown of washed fruit was separated and the fruit was peeled. After the eyes and damaged portions of the fruit were removed, the fruit was cut into small pieces and passed through a Waring Blender. The pulp thus obtained was pasteurized for 10 mins. at 80-85°C, cooled and used in the preparation of jams.

Guava: Sound and rather tart fruits were washed thoroughly in potable water. Soft and over-ripe fruits were rejected as far as possible. The fruits were cut into small pieces, boiled with equal quantity of water and crushed the boiled mass with a wooden table till it showed stickiness. The seeds were removed by straining through a bamboo sieve. The pulp thus obtained was used for the preparation of jams.

Jack-fruit: From the ripe fruits, the succulent pulps were separated. The pulp was collected from the buds by straining through bamboo sieve and heated for 10 mins. at 80-85°C. Hard buds were boiled with equal quantity of water and strained in similar way. The pulps thus collected was used in the preparation of jams.

Carrot: Fully mature, fresh, uniform coloured carrots were washed thoroughly and peeled in a mechanical peeler. The carrots were cut into small pieces, cooked in boiling water for 30 mins. and drained off the liquid. The cooked pieces were then blended in a Waring Blender into pulp. This pulp was passed through a sieve (30 mesh) and removed the portions of carrot and fibre from the pulp. The resultant pulp was used in the preparation of jams.

Watermelon: The fruits were cut into pieces. The crimson red edible portion was separated from the white rind. The seeds were removed from the edible portion. It was then blended into pulp in a Waring Blender. The pulp thus obtained