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A COMMODITY TREATMENT AGAINST INFESTATIONS OF THE QUEENSLAND FRUIT FLY, Dacus (Strumeta) tryoni (Frogatt), IN KENSINGTON MANGOES

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SUMMARY

Fumigation with 20 g m^{-3} of 1, 2-dibromoethane (EDB) for 2 h at 20°C is effective as an interstate commodity treatment against infestations of the Queensland fruit fly *Dacus (Strumeta) tryoni* (Froggatt) in Kensington mangoes packed in commercial cardboard cartons.

I. INTRODUCTION

The export of mangoes from Queensland to South Australia, Tasmania, Victoria and to Western Australia is at present forbidden because of potential infestation of the fruit by the Queensland fruit fly *Dacus* (*Strumeta*) *tryoni* (Froggatt). In order to open up wider markets for fresh Queensland mangoes, investigations on a possible commodity treatment were initiated under the aegis of the Australian Fresh Fruits Disinfestation Committee. This paper reports the results of investigations using 1, 2-dibromoethane (EDB) as a fumigant.

The standard of control specified by Australian Governmental authorities for the purpose of interstate trade is 99·99% mortality for both eggs and larvae. The effectiveness of a treatment is determined by comparing the survival to the pupal stage in treated and untreated samples. The number to be tested at the specified level of control is found from the binomial distribution. At the 95% confidence level, the specified mortality of 99·99% is achieved after 30 000 individuals have been obtained in the controls, with no survivors in the corresponding treated samples.

II. MATERIALS AND METHODS

Ripening Kensington mangoes were infested by exposing them to a laboratory strain of adult flies in a large cage at 25°C for 30 min. One face of the fruit was marked with a felt-tipped pen and pricked 50 times with a 21-gauge needle to facilitate egg laying. This face was placed uppermost in the cage.

The infested fruit were kept in plastic boxes for 1 day at 20°C (eggs) or in rearing cages for 6 to 7 days at 27°C (larvae) before being treated.

The wooden rearing cages, 86 cm long, 40 cm wide and 40 cm high, were covered on the four sides with Swiss organdie to exclude extraneous insects and to allow ventilation. On the front face of each cage was a hinged, organdie-screened door held shut by wooden turn-cocks. Each cage accommodated three plastic food crispers, 28 cm square by 13 cm high. The naked fruit were placed on an organdie cover tied over the top of the crisper, a smaller upturned plastic box being placed inside first to take the weight of the fruit. Any liquid from the fruit ran into the food crisper. Larvae from the fruit pupated in a layer of dry sawdust (previously sieved through a 1·7 mm Endecott sieve) spread on the floor of the cage.

Fruit infested with eggs were already at the chosen fumigation temperature of 20°C when required for treatment. Fruit infested with larvae were cooled from 27°C to 20°C by holding overnight at the latter temperature before treatment. Egg and larval fumigations were done separately.

Fruit from each fly cage were divided into control (untreated) and treated lots, the number in the treated lot being five times that in the control. Fruit for treatment were packed into commercial cardboard cartons (10 kg capacity) which had ventilation holes down each side and at the ends equal in area to approximately 1% of the surface area of the carton.

Two cartons, constituting approximately 40% of the chamber volume, were used for each fumigation.

The 0·16 m^3 fumigation chamber was of 20-gauge galvanized iron, 91 cm high by 42 cm square. Air circulation during the entire fumigation was by means of a 17·8 cm Woods sealed-motor fan located on the floor of the chamber beneath a 2·5 cm mesh metal grille. A water-seal collar received the flanged galvanized iron lid and prevented gas leakage. Measured volumes of fumigant were injected through a silicone-rubber septum in the lid into a 25 ml beaker contained in a hot sand bath. This was placed on a support directly beneath the septum and served to vaporize the liquid fumigant. The temperature of the fumigation room was maintained at 20°C.

The fruit were aired for 15 minutes in the chamber after fumigation with air drawn through the chamber by way of 4·5 cm diameter inlet and outlet ports. Tests with a halide detector lamp indicated that the chamber was cleared after 4 min.

After airing, the fumigated fruit were held in a carton at 27°C for 1 day (larvae) or 3 days (eggs). The fruit were then removed from the carton and placed in the rearing cages at 27°C in order to obtain survivors to the pupal stage. Control fruit were placed in other rearing cages at 27°C immediately after fumigations were complete. Periodic counts were made of pupae sieved from the sawdust in both the treated and control cages. Any pupae found on the outside of the fruit were added to the total.

The number of pupae expected in the treated was five times that found in the control. The difference between the number expected and the number actually counted in the treated gave the number of individuals killed by the treatment, hence the percentage mortality. Treatments at any one dosage were continued until either 30 000 or more pupae had been obtained in the summed controls, with no survivors in the treated, or until survivors appeared in the treated before 30 000 had been obtained in the controls.

Inorganic bromide residues in fruit fumigated with EDB were determined by X-ray fluorescence (Hargreaves *et al.* 1973).

III. RESULTS AND DISCUSSION

The results in table 1 show that a dosage of 20 g m^{-3} EDB for 2 h at 20°C gave no survivors out of more than 30 000 treated eggs and larvae of the Queensland fruit fly in mangoes packed in commercial cardboard cartons. This meets the requirements of Australian Governmental authorities for the purpose of interstate commodity treatments. The treatment gave a maximum residue of 5·8 p.p.m. inorganic bromide after 7 days (table 2) which is well below the maximum level of 20 p.p.m. inorganic bromide recommended by the Australian National Health and Medical Research Council. The results of the investigation have been accepted by the Australian Fresh Fruits Disinfestation Committee for treatments to commence with the 1975 mango crop.

TABLE 1

COMMODITY TREATMENT TESTS USING EDB FUMIGATION FOR 2 h AT 20°C AGAINST 1 DAY OLD EGGS AND MATURE LARVAE OF THE QUEENSLAND FRUIT FLY IN MANGOES

EDB Dosage g m^{-3}	Eggs		Larvae	
	Total Treated	Survivors	Total Treated	Survivors
18	10 865	6	..	..
20	50 166	0	31 220	0
24	31 434	0	..	..

Fruit in commercial cardboard cartons
Chamber load approximately 40%

TABLE 2

INORGANIC BROMIDE RESIDUES IN MANGOES FUMIGATED WITH 20 g m^{-3} EDB, 2 h AT 20°C

Treatment	No. of Days after Fumigation	EDB as p.p.m. Br in Fresh Weight of Flesh	
		Test 1	Test 2
Control	..	0·1	0
Treated	0	1·6	1·4
Treated	1	4·0	3·3
Treated	3	4·8	4·7
Treated	7	5·8	4·5

Maximum limit recommended by National Health and Medical Research Council—20 p.p.m. inorganic bromide

REFERENCES

HARGREAVES, P. A., WAINWRIGHT, D. H., and HAMILTON, D. J. (1974).—A method for the estimation of 1, 2-dibromoethane in vegetables. *Pestic. Sci.* 5:225-9.

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