Pakistan J. Sci. Ind. Res., Vol. 29, No. 6, December 1986

OPTIMUM SUGAR LEVEL IN A WHEAT BASED LARVAL DIET FOR REARING OF MELON FLY, *DACUS CUCURBITAE* (Coq.)*

Sana Ullah Khattak, N. Tanaka** and E.J. Harris***

Nuclear Institute for Food and Agriculture, Tarnab, Peshawar

(Received October 13, 1985; revised July 7, 1986)

The effect of five sugar levels, *viz.* 0, 3, 6, 9 and 12 % in the standard 3 % yeast, wheat based melon fly (*Dacus cucurbitae* (Coq.) larval diet was investigated. The results from three successive generations reared on each diet showed that 6 % sugar gave significantly higher pupal recovery and weight, percent adult eclosion, fecundity and egg hatchability. Sugar levels 9, 3, 0 and 12 % followed in that order.

Key words: Melon fly, sugar levels, larval diet.

INTRODUCTION

Dacus cucurbitae (Coq.), commonly known as the melon fly is a serious pest of horticultural crops in tropical and subtropical countries [1]. In the NWF Province of Pakistan it has been reported to cause 20-75 % damage in melons [2] and 52-70 % in persimon and other cucurbits [3].

A prerequisite for sterile successful release of sterile fruit flies is a regular and continuous supply of genetically normal insects. For this purpose large scale mass cultures are maintained under controlled laboratory conditions. *Dacus cucurbitae* (Coq.) has been mass reared in the Hawaiian Fruit Flies Laboratory since 1960 for the implementation of sterile release programme when Mitchell *et al* [4] developed a larval rearing medium containing powdered dehydrated carrots. However, cheaper bulking materials like wheat bran [5], wheat shorts [6], fluid larval medium [7] and protein products [8] were also tried and proved productive.

Granulated sugar, i.e sucrose being a carbohydrate and an important constituent of such larval diets has a significant effect on the growth and development of *D. cucurbitae* maggots [1]. Since sugar is one of the cheapest ingredients and easily available in Pakistan, the present studies were undertaken to determine the effect of various sugar levels on the reproductive potential and development of *D. cucurbitae* and to find an optimum level for standard culturing of this species.

MATERIALS AND METHODS

Diet formulations used in this study are listed in Table 1 which is a modification of the previous diets developed at this institute. The diet was prepared by mixing sodium benzoate, nipagin (methyl-*p*-hydroxy benzoate), dried torula yeast, and sugar with tap water in a 450 ml plastic cup. HCl and wheat mill feed were then added and mixed well until the diet became smooth. Onto each cup, approximately 1100 eggs, estimated volumetrically [4]

Table 1. Composition of larval diet with varying levels of granulated sugar.

	Weight (g)				
	Larval diet with indicated % sugar				
Ingredients	0	3	6	9	12
Sodium benzoate	0.1	0.1	0.1	0.1	0.1
Nipagin	0.1	0.1	0.1	0.1	0.1
Dried torula yeast	3.0	3.0	3.0	3.0	3.0
Granulated sugar	0	3.0	6.0	9.0	12.0
Hydrochloric acid (ml)	0.2	0.2	0.2	0.2	0.2
Wheat milled feed	26.6	25.6	26.6	25.6	25.6
Tap water (ml)	70.0	68.0	64.0	62.0	59.0
Total weight (g)	100.0	100.0	100.0	100.0	100.0

*(See page 463, just before reference).

**California-Hawaii Medfly Laboratory, 205 Koulu Street, Honolulu, Hi 96813.

***Tropical Fruit and Vegetable Research Laboratory, USDA AR., Post Box 2280, Honolulu, Hi 96804, USA

were seeded, covered with a muslin cloth, and held at 27 ± 1°C and 70-100 % R.H.

Each treatment was replicated four times. At 4 days after egg set, each culture was transferred separately into paper sacks containing fine vermiculite and held at 20 ± 4°C for 6 days. Pupae from each sack were shifted and the number of pupae recovered, was estimated by weight. Samples of 100 pupae from each culture were held in qt. cages and emerging adults were fed sugar, protein hydrolysate and water. Adults were allowed to oviposit eggs at age 10, 17 and 24 days by inserting into qt. cages a plastic 1-fluid oz. creamer cup. Egg production and hatchability were determined for each of the 3 generations. Pupal recovery, weight, percent adult emergence, egg production and hatchability were recorded from each generation. The data obtained were subjected to analysis of variance and the means ranked by using Duncan's New Multiple Range Test [9].

RESULTS AND DISCUSSION

The results on the effect of various levels of sugar in diets on melon fly larvae (Table 2) showed that 6 % sugar with 3 % yeast gave significantly higher pupal recovery, pupal weight and adult eclosion (P = 0.05) than the diets containing 12 % or 0 % sugar while the differences between diets containing 3 and 9 % sugar were not significant.

Similarly, fecundity and fertility were significantly higher in females reared on diet containing 6 % sugar than on diets with 9, 3, 0 and 12 % sugar in that order (Table 3). Larvae usually matured on the 6th day after egg set in all treatments except those reared on diets containing 12 % sugar which took 2 days longer.

The larval diet reported by Tanaka *et al.* [6] for rearing the Med fly (*Ceratitis capitata* Wiedmann) and the oriental fruit fly (*Dacus dorsalis* Hendel) was not suitable for rearing larvae of the melon fly (*Dacus cucurbitae* Coq) until the sugar level was reduced from 12 to 6 %. This shows that the sugar requirements of *D. cucurbitae* larvae are less than those of *D. dorsalis* and *C. capitata* larvae. For *D. cucurbitae* these authors used 6 % sugar along with wheat shorts (The Major ingredient) while we used different levels of sugars (0-12 %) in combination with wheat milled feed and 3 % yeast. Similarly, it has also been reported by other workers [10, 11, 12] that glucose, fructose, sucrose and maltose were amongst the sugars well utilised by *D. cucurbitae*. Our results fully support this contention in the sense that in our test diets with 6 % sugar also supported the best overall development of *D. cucurbitae*. Schroeder *et al.* [7, 8] developed larvel diet consisting of a fluid medium and protein products containing 6 % granulated sugar for melon fly (*D. cucurbitae* Coq.) that also proved productive, although other ingredients in these diets were different

Table 2. Comparative effectiveness of larval diet with varying levels of granulated sugar for rearing of melon fruit flies, *Dacus cucurbitae* (Mean ± S.E.) (a, b).

Larval diet with indicated % sugar	F1			F2			F3		
	Pupal recovery (c) (%)	Pupal weight (c) (mg)	Adult eclosion (d) (%)	Pupal recovery (%)	Pupal weight (mg)	Adult eclosion (%)	Pupal recovery (%)	Pupal weight (mg)	Adult eclosion (%)
0	45.6 ± 2.5 cd	12.2 ± 0.5 c	89.2 ± 0.8 cd	53.1 ± 2.4 d	15.6 ± 0.4 abc	90.0 ± 1.6 cd	55.5 ± 3.3 cd	15.8 ± 0.3 bc	87.0 ± 1.3 c
3	50.2 ± 2.7 bc	13.2 ± 0.4 bc	92.5 ± 1.0 abc	60.0 ± 3.9 bc	15.9 ± 0.5 abc	93.0 ± 0.9 abc	57.0 ± 4.7 bc	16.0 ± 0.4 abc	91.0 ± 1.7 b
6	59.9 ± 3.1 a	15.4 ± 0.7 a	96.0 ± 1.0 a	71.2 ± 1.9 a	17.0 ± 0.6 a	96.0 ± 0.2 a	74.2 ± 3.6 a	17.1 ± 0.3 a	95.0 ± 0.7 a
9	53.8 ± 5.2 ab	14.2 ± 0.2 ab	93.7 ± 1.4 ab	63.1 ± 1.6 b	16.2 ± 0.5 ab	94.7 ± 0.7 ab	64.4 ± 4.4 b	16.5 ± 0.5 ab	92.0 ± 1.2 ab
12	42.2 ± 2.1 d	11.8 ± 0.3 c	87.0 ± 1.4 d	47.6 ± 2.6 e	13.7 ± 0.4 d	88.2 ± 1.2 d	48.7 ± 3.2 d	12.4 ± 0.3 d	83.0 ± 1.5 d

a. Each value is a mean of 4 replicates.
b. Mean followed by the same letter are not significantly different at the 5% level of significance.
c. Recovery based on hatchable eggs.
d. Based on 100 pupae/replicate.

Table 3. Fecundity and fertility of adult melon fruit flies reared on diet with varying levels of granulated sugar (Mean ± S.E.) (a, b)

Larval diet with indicated % sugar	F1		F2		F3	
	No. of eggs	% egg hatch	No. of eggs	% egg hatch	No. of eggs	% egg hatch
0	1466.5 ± 105 d	84.6 ± 2.5 c	3620.8 ± 190 d	89.2 ± 0.7 c	3345.8 ± 109 d	89.5 ± 1.0 bc
3	1581.0 ± 101 c	89.2 ± 1.5 bc	4102.0 ± 142 c	91.3 ± 0.6 bc	4147.9 ± 349 c	90.4 ± 0.5 bc
6	2268.0 ± 146 a	95.8 ± 0.5 a	4812.0 ± 301 a	96.3 ± 0.3 a	5179.1 ± 115 a	94.7 ± 0.3 a
9	1856.2 ± 108 b	90.9 ± 0.5 b	4445.8 ± 146 b	92.8 ± 0.6 b	4674.9 ± 129 b	92.4 ± 0.9 ab
12	1283.3 ± 64 e	81.4 ± 1.7 d	3159.9 ± 174 e	85.9 ± 0.8 d	2839.1 ± 136 e	84.2 ± 1.6 d

a. Each value is a mean of 3 egging or 3 successive egg hatches in a 3-week period.
b. Adults fed protein hydrolyzate.

from those that we used. Our findings are in close conformity with those of Schroeder and co-workers so far as dietary needs for granulated sugar are concerned.

Srivastava *et al.* [1] while investigating the qualitative carbohydrate requirements of larvae of *D. cucurbitae* also found that sucrose was the best dietary source followed by fructose, maltose and ribose.

On the basis of the results of this study, it is recommended that 6 % sugar in combination with 3 % yeast in a wheat based diet is optimum for rearing larvae of the melon fly, *D. cucurbitae.*

(*This research was conducted when the senior author was on International Atomic Energy Agency Fellowship sponsored by the National Research Council, USA)

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