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Laboratory studies of the effects of selected tropical fruits on the larvae of *Dacus dorsalis,* Hendel

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Key words: *Dacus dorsalis;* **tropical fruits; host-suitability, larval density.**

RINGKASAN

Kajian di makmal (27° C-30° C) untuk menentukan kesusaian buah-buahan tropika pada lava D. dorsalis *menunjukkan: Betek > belimbing besi > pisang > mangga = tembikai > cempedak > limau > nenas. Pada perumah yang sesuai untuk lava iaitu betek, berat kepompong ialah 11.6 g dan edaran hidup selama 20.4 hari. Manakala pada perumah yang kurang disukai iaitu nenas, berat kepompong ialah 4.9 g dan edaran hidup 17.4 hari.*

Dalam buah betek, edaran hidup lalat buah bergantong pada kepadatan lava didalamnya. Kepadatan 10 lava dalam 20 g makanan menghasilkan edaran hidup selama 21.7 hari. Tetapi kepadatan 50 lava dalam 20 g makanan, edaran hidup ialah 15.1 hari. Peratus pemunculan lalat dewasa merosot dengan bertambahnya kepadatan lava dalam makanan.

SUMMARY

A laboratory study (27° C-30° C) on the suitability of tropical fruits for the larval development shows that it is in the order of : Papaya > carambola > banana > mango = water-melon > jackfruit > citrus > pineapple. In a suitable host i.e. papaya, the weight of the pupa was 11.6 g and life-cycle was 20.4 days. In the least suitable host i.e. pineapple, the weight of pupa was 4.9 g and life-cycle was 17.4 days.

With papaya as food, the life-cycle of D. dorsalis *depended on the density of the larvae within the food. A density of 10 larvae in 20 g of food had a life-cycle of 21.7 days, whereas a density of 50 larvae in the same quantity of food had a life-cycle of 15.1 days. The percentage of adult emergence decreased with increase in the larval density.*

INTRODUCTION

The family Tephritidae has about 4000 species, some of which are pests of tropical and subtropical fruits as well as vegetables (Christenson and Foote, 1960). The oriental fruitfly, *Dacus dorsalis,* Hendel is a major pest of fleshy tropical fruits and its geographical distribution has been listed (Hardy, 1973). The population of *D. dorsalis* has high fecundity and short generation (Bateman, 1976). In the terminology of MacArthur and Wilson (1967), *D. dorsalis* is predominantly 'r' selected i.e. a polyphygous individual that disperses widely, reproduces rapidly and exploits the environment in order to leave a maximum number of offsprings. The oriental fruitfly is capable of displacing other tephritids and also flies long distances in search of host plants (Iwahashi, 1972). The female oviposits in ripening or ripe fruits. The thickness of the skin of the fruit is not a problem for the penetration of its ovipositor (Christenson and Foote, 1960).

In Malaysia, *D. dorsalis* was recorded as a pest as early as 1928 (Corbett). Yunus and Ho (1970) listed the host plants which include both annual and perennial crop plants. Published work on the biology of the species in Malaysia were those of Miller (1940) and Ibrahim and Gudom (1978). This study is undertaken with the objectives of determining the suitable host plants as well as potential hosts of *D. dorsalis.* Thus, in this paper the larval and pupal development of *D. dorsalis* on selected fruit slices was studied in the laboratory at 27° C-30° C.

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MATERIALS AND METHODS

Eight fruit types viz. Banana *(Musa acuminate* var. Berangan*)*, Carambola *(Averrhoa carambola)*, Citrus *(Citrus medica* var. Mata Kerbau*)*, jack-fruit *(Artocarpus chempeden)* mango *(Mangifera indica* var. Alfonso*)*, papaya *(Carica papaya)*, pineapple *(Ananas cosmosus* var. Selangor Green*)* and water-melon *(Citrullus vulgaris)* were selected to determine the suitability of food hosts for larval development. The fruits were sliced into pieces of 0.5 cm thick, each having a fresh weight of 20 g. Fifteen newly laid eggs of the pest were placed on each fruit slice which was kept in a petri dish (9 cm dia) covered with muslin. The treatments for each fruit hosts were replicated four times in a completely randomized design. The period from egg deposition to adult emergence as well as pupal weight and size were recorded.

In the next experiment, the effect of larval crowding on a suitable food host was determined using ripe papaya slices. Five different levels of eggs, from the pest at 10, 20, 30, 40 and 50 were placed on each of the fruit slices. Each level of egg deposition was replicated four times in a completely randomized design. The procedure for incubation and recording was the same for the first experiment.

RESULTS AND DISCUSSION

The period from egg to adult emergence varied with different host tissues (Table 1). This took a maximum of 21.6 mean days on carambola and a minimum of 17.4 mean days on pineapple. The larval mortality for papaya, carambola, banana, mango, water-melon, jack-fruit, citrus and pineapple were 18.8%, 19.8%, 26.8%, 32.3%, 38.4%, 39.7%, 50.0% and 70.0% respectively. The variability of the larval mortality could be due to the different rate of host tissue decay (Table 2). The larvae could not fully develop in too wet a medium. Finney (1956) has reported the adverse effect of dampness on the larvae of *D. dorsalis.* With pineapple, the low pH of the fruit caused higher larval mortality (Mecion *et al.,* 1968). Therefore, when the food host was too acidic or moist, many larvae failed to pupate. Even if they successfully pupated, the pupae were lighter and smaller. Many adults failed to emerge from small pupae. Chelliah (1970), working with melon fruit-fly, *D. cucurbitae,* suggested that the larvae completed their development much faster on suitable hosts. However, there was no mention of larval development and adult emergence. Therefore, the suitability of food hosts did not necessarily depend on the growth rate of the larvae but on the weight and size of pupae and the survival rate in the various food hosts.

Though *D. dorsalis* is a polyphygous species, a varietal preference for fruit is shown by this species. This can occur within a single plant type. For example, Armstrong *et al.,* (1979) reported the resistance of pineapple varieties to both *D. cucurbitae* and *D. dorsalis.* Perhaps the pineapple varieties under investigation were equally resistant to *D. dorsalis.* In the present study, the order of host suitability is: papaya > carambola > banana > mango = water-melon > jack-fruit > citrus > pineapple. Papaya and carambola fruits are known to be favoured by *D. dorsalis* in the field. In fact, with the latter crop, the farmers have resorted to fruit bagging in the early stage to prevent crop losses (Ibrahim and Hashim, 1980). There are other related species of fruitflies such as *D. umbrosus* which are specific to jack-fruits (Yunus,

TABLE 1
The life-cycle of *D. dorsalis* in different fruits

Host	Egg & larval period (dys)	Pupal period (dys)	Total
Carambola	11.5a	10.1a	21.6
Papaya	11.3a	9.1ab	20.4
Mango	11.2a	9.1ab	20.3
Banana	11.1a	9.3ab	20.4
Jack-fruit	10.4ab	8.5ab	18.9
Water-melon	10.2ab	9.7a	19.9
Citrus	9.2b	7.8b	17.0
Pineapple	8.9b	8.5ab	17.4

Within column figures with the same letters are not significantly different at the 5 percent level as determined by Duncan Multiple Range Test.

TABLE 2
Pupal sizes, weight and adult emergence of *D. dorsalis* in different fruits

Host	Size. 1 x b (mm)		Weight (mg)	% of adult emergence
	$\bar{x}$ (1)	x (b)	$\bar{x}$	$\bar{x}$
Papaya	5.1a	2.1a	11.6a	44.5a
Carambola	4.7ab	2.0ab	10.8a	35.6ab
Water-melon	4.7ab	1.9ab	10.6a	22.2bc
Jack-fruit	4.6ab	1.9ab	10.5a	26.7bc
Banana	4.6ab	2.0ab	10.9a	31.1ab
Mango	4.5bc	1.9ab	10.1a	33.3ab
Citrus	4.1c	1.8b	6.5b	17.8cd
Pineapple	3.7d	1.5c	4.9b	8.9d

Within column figures with the same letters are not significantly different at the 5 percent level as determined by Duncan Multiple Range Test.

and Ho, 1970). *Dacus pedestris,* which also attacks the fleshy fruits, cannot be easily differentiated morphologically from *D. dorsalis.* The low infestation of *D. dorsalis* on other fruits in the field could possibly be due to the continuous presence of suitable hosts i.e. papaya and carambola. Thus in the absence of these hosts, *D. dorsalis* may pose serious problems to other fruits such as mango, banana, etc. However, the choice of female flies for oviposition in the field could be influenced by the physical and nutritional factors within the fruits (Szentsi *et al.,* 1979). For example, Greany and Szentsi (1979) reported that wild flies, *Anastrepha suspensa* (Dept: Tephritidae) preferred domed oviposition substrate.

In a suitable host, the period from egg to adult emergency depends on the density of larvae within the host (Table 3). Larval density of 50 on 20 g of food gave the shortest period of adult emergence of 15.1 days only. The short life cycle could possibly be due to the larvae which matured more rapidly in decaying fruits. It had been reported that accelerated larval development was due to the absorption of liquid pulps through larval body-wall (Christenson and Foote, 1960). With a less density of eggs, the period of larval development was lengthened which resulted in bigger and heavier pupae (Table 4). The amount of food available was known to affect the weight of the pupae (Crombie, 1944).

TABLE 3
The life-cycle of *D dorsalis* in host containing different densities of larvae

Larval density	Egg & larval period (dys) Mean	Pupal period (dys) Mean	Total
10	9.0a	12.7a	21.7
20	8.2ab	10.9b	19.1
30	7.5bc	9.8b	17.3
40	7.2bc	9.7b	16.9
50	6.6c	8.5c	15.1

Within column figures with the same letters are not significantly different at the 5 percent level as determined by Duncan Multiple Range Test.

TABLE 4
Pupal sizes, weight and adult emergence of *D. dorsalis* in host containing different densities of larvae.

Larval densities	Size: 1 X b (mm)		Weight (mg)	% of adult emergence
	$\bar{x}$ (1)	x (b)	$\bar{x}$	$\bar{x}$
10	4.3a	2.0a	9.9a	46.7a
20	4.1b	1.9b	7.5b	45.0a
30	4.0bc	1.9b	7.4b	28.9b
40	4.0bc	1.8c	6.9bc	19.2b
50	3.9bc	1.8c	6.3c	16.7b

Within column figures with the same letters are not significantly different at the 5 percent level as determined by Duncan Multiple Range Test.

The average larval mortality with 10, 20, 30, 40 and 50 per unit food were 25.9%, 26.2%, 46.4%, 47.1% and 63.3% respectively. In a crowded situation of 50 larvae in 20 g of food, the competition for food resulted in small pupae. These small pupae failed to produce normal adults as Debouzie (1977) had reported. High pupal mortality of *C. capitate* (Dept : Tephritidae), according to Debouzie, increased with larval density within a host. Therefore, larval overcrowding not only produced small pupae but a low percentage of adult emergence.

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