Pertanika, 2(1), 58-61 (1979)

Trapping of the Fruit-flies, *Dacus* spp. (Diptera: Tephritidae) with methyl eugenol in Orchards

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Key words: Fruit-fly; *Dacus dorsalis*; Methyl eugenol; Insecticides; Slit hole traps; Orchards.

RINGKASAN

Penangkapan lalat buah, Dacus *spp. (Diptera: Tephritidae) dengan menggunakan bahan panarek, methyl eugenol selama 5 minggu telah dijalankan di kawasan dusun Gombak, Selangor. Keputusan menunjukkan perangkap jenis 'Slit hole' adalah lebeh berkesan dalam penangkapan lalat buah. Lebeh daripada 85% lalat yang ditangkap adalah lalat jantan,* Dacus dorsalis, *Hendel. Apabila berbagai formulasi methyl eugenol: Malathion 50EC + methyl eugenol, Carbaryl 85S + methyl eugenol, Dipterex SP 95% + methyl eugenol dan air + methyl eugenol digunakan di kawasan Serdang, perbezaan significant tentang bilangan penangkapan lalat buah cuma didapati diantara perangkap yang mengandongi penarek + racun serangga dengan tanpa beracun. Cara yang telah digunakan itu didapati berkesan dalam pengawalan lalat buah oleh kerana terdapat kekurangan kerosakkan pada buah Carambola sebanyak 20%.*

SUMMARY

Field trapping of fruit-flies Dacus *spp. (Diptera: Tephritidae) using methyl eugenol over a five week period was conducted in a fruit farm at Gombak, Selangor. The results showed that traps with slit holes caught the greatest number of fruit-flies. Over 85% of the flies caught were male,* Dacus dorsalis, *Hendel. When different formulations of methyl eugenol; Malathion 50EC + methyl eugenol, Carbaryl 85S + methyl eugenol, Dipterex SP 95% + methyl eugenol and distilled water + methyl eugenol were tested at Serdang significant differences were only detected in the number of flies trapped in those traps with methyl eugenol + insecticides and those with methyl eugenol alone. The technique used was effective in controlling the fruit-flies for there was a reduction of 20% of damaged carambola fruits.*

INTRODUCTION

Fruit-flies (Diptera: Tephritidae) are considered a major economic pest problem especially in developing countries. New important fruit production areas are being threatened because some fruit-flies are currently expanding their geographical areas. (Cunningham *et al,* 1978). The most notorious fruit-flies are the Mediteranean fruit-fly (*Ceratitis capitata,* Wiedemann), Oriental fruit-fly (*Dacus dorsalis,* Hendel), melon fruit-fly (*D. cucurbitae,* Coquilett) and Queensland fruit flies *(D. tryonii).*

In Malaysia, Yunus and Ho (1970) recorded 28 Tephritids damaging both tropical fruits and vegetables. The dominant species are *D. dorsalis, D. cucurbitae* and *D. umbrosus.* Though these species are polyphagous yet they show preferences for certain crop species. For instance, *D. umbrosus* is more common in jack-fruits. The diverse range of host plants affected by fruit-flies species show their wide adaptability.

Some aspects of the biology of the dominant species, *D. dorsalis* using fresh papaya medium have been studied. (Miller, 1940; Ibrahim and Gudum, 1978). The eggs are laid in the fruit rinds and the larvae on hatching burrow and feed, well protected within the fruits. When the fruit drops they pupate at a depth of 2 – 3 cm. in friable soil (Ibrahim and Mohamad, 1978) emerging only as adults to reinfest the fruits. The depth of pupation of Tephritids is not affected by biochemical properties of the soil but by their physical structures (Cavalloro and Delria, 1975). The absence of a weak link in their biology makes it imperative for control measures to be affected

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during their adulthood. Further, the situation here is made more difficult as fruit-flies breed all the year round.

Several methods are currently being used for their control. Sanitary and cultural techniques are commonly practised. Fruit farmers also resort to wrapping their crops with papers in the case of carambola fruits or with thatched palms fronds or jute or perforated polythene sacking for larger fruits. Vegetable farmers use insecticides. Biological control and Sterile Insect Technique (Harris, 1975) have not been adopted in Malaysia but attractants such as methyl eugenol have been used on a limited scale as its reliability is questionable.

The present study was undertaken to evaluate the effectiveness of trap designs using methyl eugenol and also to assess the efficiency of different insecticides when incorporated with methyl eugenol.

MATERIALS AND METHODS

Field trials were conducted at two sites namely Gombak (12th milestone K.L. – Kuantan) and Serdang, Selangor. The former was a mixed fruit farm consisting of Citrus (*Citrus* spp.), rambutan *(Nephalium lappaceum)* and durian *(Durio zebethinus)*. The Serdang site consisted only of Carambola trees *(Averrhoa carambola)*. Fruit-fly trapping using methyl eugenol was carried out for five consecutive weeks at each site.

The traps were hung to each tree, spaced 9 m apart, 1.5 m above the ground. Every third day, the traps were recharged with water or insecticide solutions and the trapped fruit-flies were counted and identified. The design used was a Completely Randomized Block with four replications. The treatments within each block were again replicated four times. The results were analysed and the means were separated with the Duncan Multiple Range Test.

Trial I: Types of trap design

This trial, at Gombak, started in the first week of July 1972. Four different types of trap designs viz, round hole, slit hole, square hole and rectangular hole were tested (Fig. 1). Each trap was fitted with two pieces of wire (diam 0.1 cm) for suspending the traps horizontally on each tree. A piece of cotton-wool soaked with methyl eugenol (2 ml) and sufficient water to wet it was suspended from the top surface of each trap. A total of 64 trees were used covering an area *ca.* 0.5 hectare.

Trial II: Incorporation of methyl eugenol with different insecticides

This trial, at Serdang, started in the second week of September, 1972. The three different insecticides viz. Malathion 57 EC, Carbaryl 85S and Dipterex SP 95% were each incorporated with methyl-eugenol. The cotton wool within each trap was soaked with the specified insecticide (10 cc/gall) and methyl eugenol (2 ml). A total of 128 trees were used covering an area *ca.* 1.25 hectares. Assessment of damaged fruits based on the presence of feeding punctures was made by selecting 100 ripe fruits at random before as well as at the end of the field trial.

RESULTS AND DISCUSSION

Dacus dorsalis was the predominant species caught both at Gombak and Serdang. At Gombak it comprised 86.7% and at Serdang 98.4%. The remainder were *Dacus umbrosus* and *D. cucurbitae*. Methyl eugenol therefore attracted mainly *D. dorsalis*. Similar results were also obtained by Miller (1940) and Shah and Patel (1976). *D. umbrosus* is essentially a pest of jack-fruit (Yunus and Ho, 1970) and its presence could be attributed to the *Artocarpus* plants in the vicinity. The death of the fruit-flies within the traps charged only with methyl eugenol and water was mainly due to overfeeding (Steiner, 1952a). The attractiveness of methyl eugenol to *Dacus* species could be attributed to its resemblance to the sex hormones of the fruit-flies (Fletcher *et al,* 1975).

Table 1 shows that there is no significant difference between the number of fruit flies caught in the traps with slit holes, round holes and square holes. However, slit hole traps showed significantly different ($P<0.05$) catches from those caught with rectangular hole traps. The containers used for making the traps were of similar shape and size but the size of the opening varied (Fig.1). The total area for the opening for the slit hole, square hole, round hole and rectangular hole were 26 sq. cm, 98 sq. cm, 100 sq. cm, and 150 sq. cm. respectively. Therefore, the efficiency of the split hole traps could possibly be due to the smaller opening which prevented the accumulation of dew or rain water. Normally, the fruit-flies would walk round the inner surface of the trap. The presence of excess water in the traps prevented the fruit-flies from approaching the attractant resulting in a fewer number of trapped species.

In a further trial (Table 2) using different insecticides incorporated with methyl eugenol in the split hole design traps, the results showed a significant difference in the number of fruit-flies

TABLE 1

Catches of fruit flies over a 5 week period

Type of Design	Range	Total	Mean nos caught/trap
Round Hole	1 – 263	1118	139.7 ab
Square Hole	63 – 311	1277	159.6 ab
Rectangular Hole	4 – 260	1007	125.8 b
Slit Hole	24 – 586	2055	250.6 a

* Within column figures with same letters are not significantly different at 5% level.

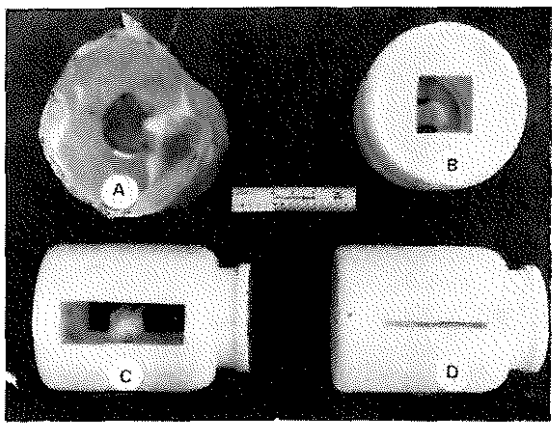

Fig. 1: Four different types of trap designs (A) Round (B) Square (C) Rectangular and (D) Slit holes.

trapped with methyl eugenol + insecticides and those trapped with methyl eugenol alone. The fact that the number of fruit-flies trapped with methyl eugenol alone was smaller could possibly be due to escape of flies after tasting of the attractants. Although fruit-flies are attracted to chemicals such as ammonia or fermented fruits (Gow, 1954) the odour of insecticide alone failed to attract a single specimen. Today, paste like formulations of attractants (Methyl eugenol + pesticides) are being used in Southern California for controlling Oriental fruit-fly (Cunningham *et al.* 1975).

Analysis of the costing showed that trapping of fruit-flies is much cheaper than spraying with insecticides (Table 3). The cost could

TABLE 3

Total expenditure of using 2 different methods of fruit-fly control over a 5 week period

		(SM)
A:	*Blanket Insecticidal Spray*	
	Equipment:	
	Mist blower and safety gadgets	850.00
	Supplies:	
	Insecticides and Wetting agents	30.00/ha
	Labour @ $10/man-day	60.00/ha
	Total:	940.00
B:	*Sex attractant + insecticides*	
	Equipment:	
	Insect traps @ $1.00	130.00
	Supplies:	
	Methyl eugenol @ 10c./trap	30.00/ha
	Insecticides @ 10c./trap	10.00/ha
	Cotton wool	5.00/ha
	Labour @ $10/man-day	120.00/ha
	Total:	295.00

TABLE 2

Catches of fruit flies with different insecticides using split hole traps

Insecticide formulation	Range	Total	Mean no caught/trap
Malathion + Methyl eugenol	16–215	518	64.7 a
Carbaryl + M. eugenol	15–138	572	71.5 a
D pterex + M. eugenol	16–274	694	86.7 a
Water + M. eugenol	1–67	211	26.3 b
Water + Malathion	0	0	–
Water + Carbaryl	0	0	–
Water + Dipterex	0	0	–

Within column figures with same letters are not significantly different at 5% level.

be further reduced by using cheaper containers and proper spacing of the traps. Methyl eugenol is known to attract *Dacus dorsalis* at least 0.8 km away and can last for six months (Steiner, 1952a). Though methyl eugenol is only effective against the male fruit-flies it indirectly contributed to the reduction of the fruit-fly population in the long term. For instance, in Serdang ninety per cent of the carambola fruits were attacked before the trial but five weeks later, the damaged fruits were lessened to 70%.

Though the reduction in fruit damage was small (20%) it had the advantage of preserving the natural enemies. Blanket spray with insecticides would kill both target and non-target organisms. Furthermore, the conventional method of bagging the fruits is very laborious and time consuming. This male annihilation technique is a feasible method of controlling Oriental fruit-fly, *Dacus dorsalis* Hendel in Malaysian orchards and Steiner *et al.* (1965) have proved its effectiveness in Hawaii.

CONCLUSION

When methyl eugenol was placed in various trap designs, the number of fruit-flies trapped with split holes showed no significant difference from those trapped with round holes and square holes. There was a significant difference, however, between those trapped with the split hole and those trapped with rectangular holes. Over eighty-five per cent of the Tephritids caught were male Oriental fruit-fly, *Dacus dorsalis* Hendel. In a further trial using the split hole design, which was separately incorporated with three different insecticides and methyl eugenol, there was no significant differences in the number of trapped fruit-flies. This suggested that all the insecticides tested were equally effective. There was a reduction of twenty per cent in carambola fruit damaged five weeks after the initial trapping. Evidently, the use of methyl eugenol + insecticides was cheaper and less laborious than use of the blanket insecticidal spray and fruit bagging.

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(Received 2 November 1978)