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Effective trap density for mass trapping of fruit flies, *Bactrocera dorsalis* (Hendel) and *Bactrocera zonata* (Saunders) in mango

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ABSTRACT: Fruit flies are among the major pests of fleshy fruits which affect production throughout the world and represent the most economically important group of polyphagous Diptera. Use of male pheromone traps is a widely followed approach to manage fruit flies, *Bactrocera dorsalis* (Hendel) and *Bactrocera zonata* (Saunders) (Tephritidae: Diptera) in mango. Using effective trap density is critical for achieving adequate control of fruit flies. In this regard, an investigation was conducted to evaluate the trap densities for mass trapping of the mango fruit fly. Results revealed that the highest numbers (2710.33 fruit flies/trap/month) of fruit flies were trapped with density of 25 traps/ha, followed by 20 traps /ha (2247.90). While, the lowest numbers (885.89 fruit flies /trap/month) of fruit flies were trapped in 5 traps/ha. Based on the findings, use of 25 methyl eugenol traps per hectare is considered optimum to reduce fruit fly population in mango.

Keywords: Fruit fly, *Bactrocera dorsalis*, *Bactrocera zonata,* mango, trap density, *Mangifera indica,* methyl eugenol

INTRODUCTION

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae and is native to South Asia, from where it has been distributed worldwide to become one of the most widely cultivated fruit crops in the tropics. The production of mango is often impended by the tephritid fruit flies, which hamper the production and export (Verghese *et al.,* 2002; Singh *et al*., 2010). The Oriental fruit fly, *Bactrocera dorsalis* (Hendel) and peach fruit fly, *Bactrocera zonata* (Saunders) are very important pests of fruit crops and are recognized worldwide as the most important threat to horticulture (Ekesi and Mohamed, 2011). Farmers with small orchards could improve production by applying field sanitation along with IPM involving male annihilation (Verghese *et al*., 2006). Whereas, application of insecticides further disrupts the ecosystem and causes numerous hazards, which in the present scenario warrants the need of integrated approach for fruit fly management (Verghese *et al*., 2012). In this regard, there is urgent need of integrated approach for fruit fly management. Among the various alternate strategies available for the management of fruit flies, use of methyl eugenol traps stand as the most outstanding alternative (Drew, 1991; Drew and Hancock, 1994). As mass trapping is considered as better option for management of fruit flies, the number of traps / acre have a direct impact on the number of quality marketable fruits / tree (Singh and Sharma, 2012). However, the trap density needs to be adjusted based on many factors including trap efficiency, lure attractant efficiency, altitude, presence of alternate hosts, climate, topography and type of fruit fly species. Thus, new trap devices and density of the traps must be evaluated to control fruit flies in a more cost-effective manner. In this view, our study was carried out to evaluate the effective trap density for the mass trapping of mango fruit flies.

MATERIALS AND METHODS

Study to find the optimum trap density for mass trapping of fruit flies in mango was conducted during 2018-19 and 2019-20 by using Sawaj fruit fly traps in farmers' orchards in Vanthali and adjoining villages in Junagadh District of Gujarat, India. Sawaj fruit fly traps were taken from Bio-control Research Laboratory, Department of Agricultural Entomology, College of Agriculture, JAU, Junagadh. The transparent 500 mL trapezoid Sawaj fruit fly traps were used for trapping of the mango fruit flies. Each Sawaj fruit fly trap has four holes of 2.5 cm in size on four sides and contained soft wooden block of 5 × 5 × 5 cm size that were containing 8 mL methyl eugenol + 8 mL methanol + 2 mL malathion. Wooden block was placed inside the trap with loop made of polythene string. The Sawaj fruit fly traps were placed 2 to 3 meters above the ground level. Moreover, care was taken to maintain a distance of 50 m between two traps to avoid trap interference and the position of traps was randomly changed and blocks were charged at fortnight intervals to nullify the effect of trap position in attracting fruit fly. The details of different treatments were T_1-5 traps/hectare, T_2-10 traps/hectare, T_3-15 traps/hectare, T_4-20 traps/hectare, and T_5-25 traps/hectare. Approximately 5 to 10 km distance was maintained between the treatments to reduce the interfering effect of different treatments. The total number of male fruit flies recorded irrespective of species in each trap from mango orchard at weekly intervals and average fruit fly per trap per week was worked out. The data obtained was statistically analyzed. The experiment was designed using Completely Randomized Design (CRD) with five treatments, and five replications during the mango growing seasons (March to August) of 2018-19 and 2019-20.

RESULTS AND DISCUSSION

During the study, two predominate mango fruit fly species, *viz., B. dorsalis* and *B. zonata* were mass trapped in different density of traps and the results in terms of number fruit flies recorded irrespective of species per trap per week during the mango season and discussed as hereunder:

Year 2018-19

The mean numbers of fruit flies attracted per trap per month in different treatments are shown in Table 1 during the year 2018-19. It was observed that the maximum numbers of fruit flies were trapped significantly in T_5 (25 traps / ha; 2979.72 fruit flies / trap / month), followed by T_4 (20 traps / ha; 2537.49 fruit flies / trap / month), T_3 (15traps / ha; 1797.45 fruit flies / trap / month) and T_2 (10 traps / ha; 1396.79 fruit flies / trap / month). Whereas, the lowest numbers of fruit flies were trapped in T_1 (5 traps / ha; 981.89 fruit flies / trap / month).

Mean of five replications; Figures in parenthesis are square-root transformed, while outside values are original values

Table 1. The mean number of fruit flies trapped in different densities of traps

Treatment	Trap density	Mean number of male fruit flies captured/trap/month		
		2018-19	2019-20	Pooled
T_1	5 traps / ha	981.89 (31.34)	794.83 (28.19)	885.89 (29.76)
T_2	10 traps / ha	1396.79 (37.37)	1054.89 (32.48)	1219.85 (34.93)
T_3	15traps / ha	1797.45 (42.40)	1417.18 (37.65)	1601.68 (40.02)
T_4	20 traps / ha	2537.49 (50.37)	1975.85 (44.45)	2247.90 (47.41)
T_5	25 traps / ha	2979.72 (54.59)	2453.70 (49.53)	2710.33 (52.06)
S Em±		0.81	0.66	0.52
CD at 5 %		2.40	1.95	1.50
CV %		4.21	3.84	4.06
Y				
SEm±				0.33
CD at 5 %				0.95
YXT				
S Em±				0.74
CD at 5 %				NS

Year 2019-20

The mean number of fruit flies attracted per trap per month in different treatments during the year 2019-20 is given in Table 1. The maximum number of fruit flies recorded significantly in T_5 (25 traps / ha; 2453.70 fruit flies / trap / month), followed by T_4 (20 traps / ha; 1975.85 fruit flies / trap / month), T_3 (15 traps / ha; 1417.18 fruit flies / trap / month), T_2 (10 traps / ha; 1054.89 fruit flies / trap / month). While, the minimum number of fruit flies were trapped in T_1 (5 traps / ha; 794.83 fruit flies / trap / month).

Pooled (2018-19 and 2019-20)

The mean number of fruit flies attracted per trap per month in different treatments during the year 2018-2020 is shown in Table 1. From pooled data it can be conclude that there was significant difference between treatments, the highest numbers (2710.33 fruit flies/trap/month) of fruit flies trapped in T_5 (25 traps / ha), followed by T_4 (20 traps / ha; 2247.90 fruit flies / trap / month), T_3 (15 traps / ha; 1601.68 fruit flies / trap / month) and T_2 (10 traps / ha; 1219.85 fruit flies / trap / month). While, the lowest numbers (885.89 fruit flies / trap / month) of fruit flies were trapped in T_1 (5 traps / ha).

The interaction effect between year and treatments were found significant and indicated variation in treatment means during both the years. Though, significantly T_5 (25 traps / ha; 2710.33 fruit flies / trap / month) followed by T_4 (20 traps / ha; 2247.90 fruit flies / trap / month) showed consistent result during both the years.

The perusal results on the number of fruit fly trapped in different density of traps were in accordance with some past scientists. Salvador *et al.,* (2017) evaluated that the density of 25 traps per hectare was the most efficient in reducing the fruit fly populations, *A. obliqua* and *A. ludens* in mango orchards. The maximum numbers of fruit flies were captured in a density of 16 traps per acre Ravikumar and Viraktamath (2006); (Singh and Sharma, 2012). Mediouni *et al.,* (2010) captured the highest fruit flies in a density of 25 traps / ha. Further, the present results have disagreed with some studies that were found more than 30 traps per hector were effective trap density. Leza *et al.,* (2008) revealed that the mass trapping of *C. capitata* with 50 traps/ha was more effective in reducing *C. capitata.* Demirel and Akyol (2017) evaluated the density of 48 traps per 0.7 hectares (8968 flies / year) for mass trapping of *C. capitate.* There were some variations in results of present studies with earlier scientists, these might be due to the disparities in the density of the population prevalence in the study area, lure, bait techniques they adopted in the trap for the evaluation of the density of trap, reproductive capacity of pest species and prevalent weather conditions.

Study on density of traps for mass trapping of mango fruit fly revealed that significantly more fruit flies were captured with density of 25 traps/ha (2710.33 fruit flies/ trap / month) followed by T_4 (20 traps / ha). Hence, it can be concluded the most effective trap density of for mass trapping of mango fruit fly was 25 traps / ha and next better density was 20 traps / ha.

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