

Studies on the attraction, spread and distribution of tephritid fruit flies in different mango eco-systems in Kerala

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ABSTRACT: Spread and prevalence of tephritid fruit flies were based on the flowering and fruiting phenology of the mango and other host fruit trees. It was in the order of early flowering tracts to late flowering tracts as proved from methyl eugenol trap based fruit fly catches over an ecological distance from the Thrissur, Kerala to Tamil Nadu boarder. The fruit fly population was having an increasing trend from the early flowering zone of Muthalamada, Kerala regions to the late flowering zones of Thrissur, Kerala regions. The peak hour of attraction of male fruit flies to methyl eugenol bottle trap was determined to be between 4 to 6 pm and 6 to 8 am under shaded conditions.

Key words: Tephritid fruit fly, *Bactrocera Spp.*, Mango, Spread and distribution.

INTRODUCTION

Fruit flies cause tremendous economic losses and produce great havocs in production systems of both fruits and vegetables all over the world. Among 400 species of fruit flies distributed all over the world, *Bactrocera dorsalis* (Hendel) is the most destructive pest occurring in homesteads of Kerala [6] causing 25-50 per cent fruit loss in mango when harvested at the mature ripe stage. The extent of damage may go up to 80 per cent when the pest incidence occurs in an epidemic form [1,4]. Due to this menace, fruits in most of the homesteads in Kerala are being harvested at the immature stage for pickling purpose with an intention to avoid fruit damage which turns serious at maturity. In addition to mango this species attacks guava, sapota and papaya [3].

The recommended management practices against fruit fly in mango orchards are not found to be successful in checking the fruit fly because of the innumerable survival adaptations and mechanisms of the pest. Hence, new studies were made on tephritid fruit flies on possible hourly attraction of fruit flies to methyl eugenol bottle traps, spread and distribution in different mango eco-systems. These ecological studies on the fruit flies in different mango eco-system

have led to the development of effective monitoring, trapping and easy management.

MATERIALS AND METHODS

(i) Hourly Attraction of Fruit Flies: Studies on the hourly attraction of fruit flies to methyl eugenol bottle traps under shaded and unshaded conditions were carried out in the College Orchard, College of Horticulture, Kerala Agricultural University, Vellanikkara, Thrissur, Kerala during 2007. The methyl eugenol traps were installed at two locations within the shaded mango orchard and another three installed outside the mango orchard in typical non cropped areas. The mango fruit flies attracted and got killed within traps were monitored at 6 am (dawn) and at 6 pm (dusk). The traps were exposed in both the location at a height of 2 m above ground level and secured properly to avoid swinging. The twine was smeared with grease to prevent the ants from devouring the dead fly catch within the bottle traps.

(ii) Spread and Distribution of Fruit Flies: In order to search out the possibility of the possible spread and distribution of the fruit flies or the prevalence and spread of the fruit flies over time and distance across the zones from humid tropical areas

of Trichur, Kerala to dry arid tracts of Tamil Nadu through the interzonal semi dry areas of Muthalamada and Kamprathuchella covering a distance of 100 km. Ten locations at an interval distance of approximately 5-10 km were selected and

installed with three standard methyl eugenol bottle traps each per site for continuous monitoring. The tephritid fruit fly catch was taken at weekly intervals from the mango pre-season to post season during 2006-07. The locations were,

<i>Places</i>	<i>Anthropological areas</i>	<i>Type of Agro-ecosystem</i>
1) Pulikken market	Thrissur town limit	Homestead mangoes and urban
2) Mannuthy	Town suburb	Pure mango ecosystem
3) Vellanikkara	Orchard areas	Mixed fruits ecosystem
4) Pattikadu	Mixed farm areas	Rubber based plantation ecosystem
5) Vadakenchery	Mixed farm areas	Rubber + Natural ecosystem
6) Nenmara	Mixed farm areas	Rubber + rice + coconut + Homestead mango ecosystem
7) Kollengodu	Mango orchard areas	Melons + rice + coconut + Homestead mango ecosystem
8) Muthalamada	Mango orchard areas	Rice + Coconut plantation + mango ecosystem
9) Narryparachella	Mango orchard areas	Pure mango orchard ecosystem
10) Sadayanpallam	Mango orchard areas	Coconut + Mango ecosystem

The bottom of the methyl eugenol trap PET bottle was cut opened and polythene cover was fitted for easy removal and counting of the dead fruit flies. At weekly intervals, the trapped and dead flies were removed for observation and their total number was recorded.

RESULTS

(i) Hourly Attraction of Fruit Flies: The results showed that there was more attraction of fruit flies in terms of catch per trap in shaded areas than the unshaded areas. The peak time of attraction in shaded area was between 4 to 6 pm (41.8 flies/trap). Moderate attraction was noticed in the morning hours between 6 to 8 am (33.5 flies/trap) in shaded areas. During noon time between 12 to 2 pm, the traps under both shaded and unshaded area had the lowest attraction of fruit flies with 10.4 and 2.8 flies respectively (Table 1).

(ii) Spatial Distribution and Spread of Mango Fruit Fly: The mean catch of fruit flies per week per trap observed at 10 locations in Thrissur and Palakkad districts, Kerala showed a significant difference in their prevalence and spread during November fourth week, 2006 to June third week, 2007 (Fig. 1).

The data on the fruit fly mean catch per trap per week at Paravattani area of Thrissur district showed a lower catch ranging from 25 to 39.3 flies from November fourth week to second week of January. After that, there was a gradual increase in fly population which reached the peak on 3rd week of April (372 flies) and further show a gradual decrease to 172.5 flies/trap/week.

In Mannuthy location, a lower catch of 42 to 49.3 flies was observed from the fourth week of November to the second week of January and after that there was a gradual increase and reached the peak by March second week (310 flies) and again by March fourth week, 315.6 flies and subsequently the population was on a decreasing trend.

In Vellanikkara location also there was a low level of population as observed from November to second week of January (36.3 - 40 flies). The peak populations were observed during the March third week with 256.6 flies and April first week with 283.6 flies. After that the population got decreased.

In Pattikadu and Vadakkenchery locations, there were very low levels population as observed during the entire study period without any peaks as compared to other locations.

In Nenmara location, there was a medium level of population as observed from the second week of January till April third week. The peak population was obtained in April third week with 313.3 flies and afterwards the population got slowly decreased.

Among the ten locations continuously observed for the fly population, the highest level of fruit fly population and the highest peak was observed in Kollengodu location with extensive mango orchards nearby. The highest peak was observed during the April third week with 393.3 flies.

In Muthalamada, Nariparachella and Sadayanpallam locations, the fruit fly population was increasing starting from January second week onwards and the peak population was observed during the April 3rd week in all the three locations

Table 1
Diurnal response of fruit flies to methyl eugenol bottle traps under shaded and un-shaded exposures in the orchard

Hours	Total fruit fly catches at two hour intervals*											
	6-8 am		8-10 am		10-12 noon		12-2 pm		2-4 pm		4-6 pm	
	S	US	S	US	S	US	S	US	S	US	S	US
Mean	33.50 ^b	11.90 ^f	24.50 ^c	4.30 ^g	14.60 ^e	2.20 ^h	10.40 ^f	2.80 ^h	23.70 ^c	5.50 ^g	41.80 ^a	16.80 ^d

* - The figures are mean of three traps catches
 S - Shaded area, US - Unshaded area

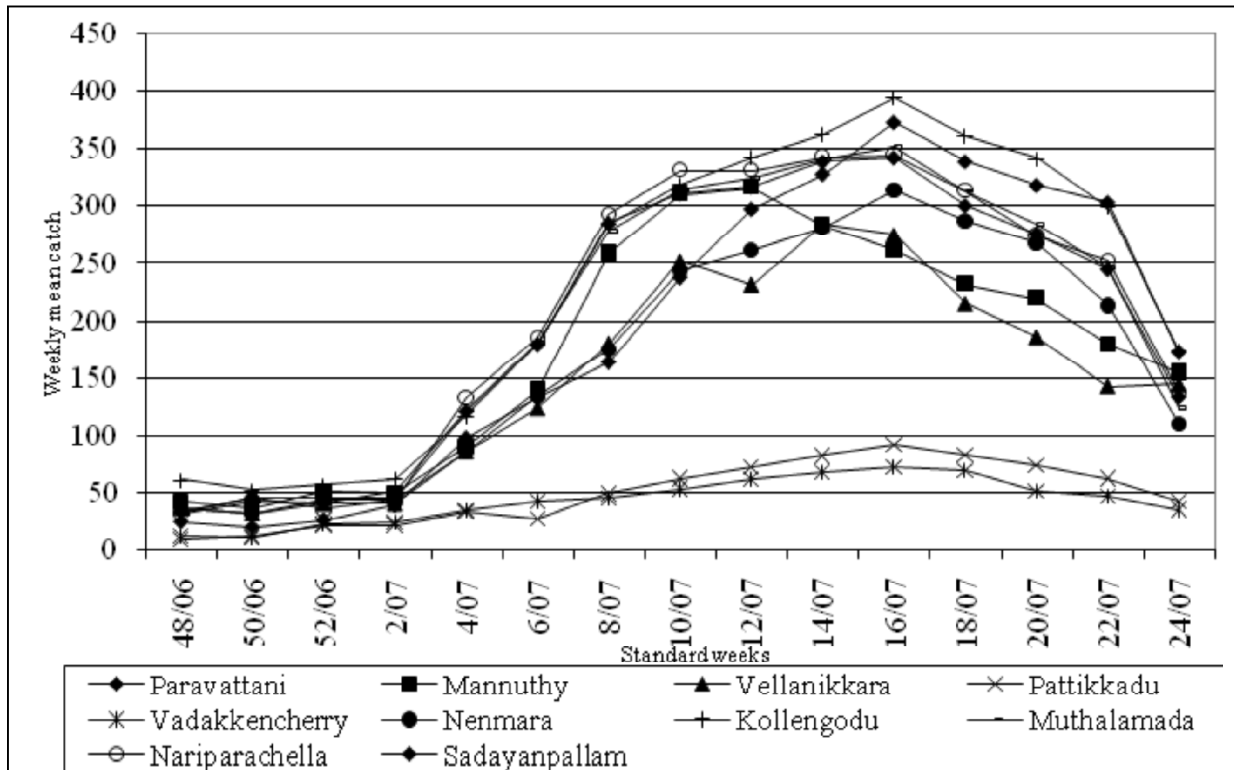


Figure 1: Flowering phenology and relative population levels of fruit flies in different mango orchard systems

with 351, 344.3 and 341.6 flies respectively. After that the population was slowly reduced and found declining

DISCUSSION

The results revealed that the peak hour of attraction of fruit flies to methyl eugenol bottle trap was found to be between 4-6 pm and between 6-8 am under the shaded canopy of mango tree. It proved that the adult flies are having more crepuscular behaviour. This might be due to the fact that, fruit flies were more active and preferential to shady and low temperature conditions. Jayanti and Verghese [2] also observed the hourly fluctuations in trap catches (baited with ME + carbaryl) of *B. dorsalis* in a mango orchard and found that the catches were maximum in the afternoon, with a peak time between 16.00 and 17.00 hours which is in conformity with the present results. The very low

catch of fruit flies observed at 6-8 am under open air conditions again proved that the flies were preferring shady and low temperature conditions to open air situations. Therefore it could be inferred that the fruit fly traps should be installed under shade on the tree canopy for optimum catch efficiency.

Generally, dispersion of insects from one place to another is for shelter, food, and oviposition based on the host phenology in fruit crops. Ros *et al.*, [5] reported that the cooler localities were affected by the migration of flies (*C. capitata*) coming from the warmer localities, on temperate fruit crops. Flowering of the mango trees is observed early in the dry zone tracts of Tamil Nadu - Kerala border areas followed by that in the transitional areas of Muthalamada region and towards in the humid areas of Thrissur tracts. Consequently the fruiting and ripening phases were also found staggered along with the fruit fly damage

in the localities as evidenced by the population level in the methyl eugenol bottle traps. Depending upon the flowering and fruiting as well as the time the relative catches of fruit flies in the methyl eugenol traps, it is evident that there is the concomitant trend of change in the fly population and fruit damage there no probability of any suspected migration across these areas. Hence the high fruit fly population is strictly in accordance with flowering and fruiting of the mango and other host fruits in the different tracts.

REFERENCES

- Abdullah, K., Akram, M. and Alizai, A. A. (2002), Non traditional control of fruit flies in guava orchards in D.I. Khan. *Pakistan Journal of Agricultural Research*. 17(2) : 71-74.
- Jayanthi, P. D. K. and Verghese, A. (1998), Hourly trap catch of the mango fruit fly (*Bactrocera dorsalis* (Hendel)) using methyl eugenol bottle trap. *Insect Environment*. 4(2): 60.
- Jiji, T., Suja, G. and Verghese, A. (2009), Methyl Eugenol traps for the management of fruit fly *Bactrocera dorsalis* Hendel in Mango. *Proceedings of the 21st Kerala Science Congress*, 28-31 January 2009 pp. 76-77.
- Latif, A. (2004), Integrated management of fruit flies (Diptera: Tephritidae) in *Pakistan*. *Annual report, Agricultural Linkages programme*. PAARC, Islamabad. pp. 1-51.
- Ros, J. P., Guirado, E. and Escobar, I. (1999), Population study of the Mediterranean fruit fly (*Ceratitidis capitata* Wied.) in subtropical crops on the coast of Granada. *Boletin de Sanidad Vegetal Plagas*. 25(4): 505-514 (in Spanish, with English abstract).
- Verghese, A., Nagaraju and Sreedevi, N. N. (2002), Pre and post harvest IPM for management of mango fruit fly, *Bactrocera dorsalis* (Hendel). Proc. of seventh Int. Sym. on Fruit flies of Economic Importance, 10-12 September 2006, Salvador, Brazil, 179-182.