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Species diversity of fruit flies in different varieties of mango in Ranga Reddy District of Telangana State, India

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Abstract

India is the largest producer of mangoes (*Mangifera indica*) with 44.14% of the total world production, continues to dominate the Indian fruit basket contributing 36% to total fruit area and 20.30% to total fruit production. In Telangana State, mango occupies 22% of total area under fruits comprising 1.2 million hectares. Mango is being exported from the State but affected by different species of fruit flies. Studies were carried out in Ranga Reddy district of Telangana state, India during the year 2018 and 2019 (two seasons) to find out species diversity of fruit flies that are damaging the important mango varieties like Banginapalli, Dasherri and Himayat. The surveillance was conducted using bottle traps with methyl eugenol as attractant. The results revealed that significant population of two species of fruit flies belongs to Genus *Bactrocera* namely; *Bactrocera dorsalis* and *B. zonata* were trapped in all the three varieties. In variety Banginapalli significantly highest number of 190.60 ± 12.51 fruit flies were trapped and followed by 67.20 ± 3.77 in Dashehari and 62.60 ± 5.99 in Himayat variety during 2018. Similarly, significantly higher number of fruit flies were trapped in Banginapalli (90.80 ± 15.81) followed by Dasherri (31.50 ± 4.75) and Himayat varieties (20.20 ± 4.26) during the year 2019. Among the two species, the oriental fruit fly, *B. dorsalis* was found dominating other species in Banginapalli variety whereas peach fruit fly, *B. zonata* found dominating in Dasherri and Himayat varieties during both years. Timely management through cultural, chemical and use of para pheromone lures as an area wide management strategy can reduce the fruit fly damage in mango.

Keywords: Mango, variety, fruit fly, surveillance, species diversity

1. Introduction

Fruit flies are responsible for 20-40% of loss in fruits and vegetables both in the field and post-harvest scenario. In some cases the damages are caused even up to 90-100%. Tephritid fruit flies are responsible for post-harvest losses in fresh fruits and vegetables. In addition they are also major impediments for export of fresh fruits and vegetables. Mango and guava are the two important fruit crops and cucurbitaceous vegetable crops are being damaged by fruit fly in the state of Telangana. Among fruits mango occupies 22% of total area under fruits and comprising 1.2 million hectares. The three top mango producing states are; Uttar Pradesh, Andhra Pradesh followed by Telangana each comprising of 25% of total area under mango production. Although India is a top mango producing country in the world accounting for 44.14% of world mango production, its share in the global market is just 15%. The main reason for decline in export is market conditions and fruit fly menace. Fruit fly damages 35-40% of mangoes during the harvesting stage. Sometimes, there is a yield loss of 80 per cent in mango due to fruit fly infestation has been reported by different workers^[1, 12]. Hence, it is considered as an important quarantine pest in India.

Fruit flies are also called 'peacock flies' placed under order Diptera and family Tephritidae found to cause damage to many soft fruits and vegetables. About 4000 species are found to be present all over the world^[14] out of which about 5% of the species are found to occur in India^[17]. Due to wide range of hosts, high climatic tolerance and high dispersal capacity distribution range of fruit flies has covered the Asia Pacific region ranging from India to Hawaii and covering all South-East Asian countries^[15]. In India out of 176 species under Family Tephritidae, 34 belonged to the genus *Bactrocera*^[10] and now the number species has reached about 270 numbers.

In general, fruit flies monitoring are being done in India using para pheromones like methyl eugenol in case of fruit crops like; mango, guava, banana, peach, orange, fig, sweet lime, etc.

and Cue lure for cucurbitaceous vegetable to attract *Bactrocera* spp. which are predominantly damaging these crops in India. These para pheromones can attract only male fruit flies. Trapping of male flies using para pheromone and killing agents and killing them to reduce the population is referred as MAT (Male Annihilation Technique). Among different naturally derived and synthetic para pheromones, methyl eugenol (ME) is found more powerful in attracting male fruit flies of oriental fruit fly, *Bactrocera dorsalis*, and several other *Bactrocera* species [6, 9, 16, 18]. The ME lure also successfully utilized in area wide management programmes due to its apparent olfactory as well as phagostimulatory action to which species of *Bactrocera* attracted. The para pheromone methyl eugenol can attract male fruit flies from a distance of 800m [11].

Studies were carried out in Ranga Reddy district of Telangana state, India during 2018 and 2019 to find out fruit fly species diversity in mango varieties like Banginapalli, Dashehari and Himayat. The data were subjected to statistical analysis and results are presented in this paper.

2. Materials and Methods

The present study was conducted at mango orchards of Jukal village (17°13'11.9"N 78°17'35.0"E) in Ranga Reddy district of Telangana state during the mango season of year 2018 and 2019. The fruit fly damages the fruits before harvest when the fruits about to ripen. In South India, the mango fruit matures during May to June months which is a suitable time for oviposition of fruit flies. However, the immature fallen fruits act as a source of breeding from the month of March. Hence, fruit fly trapping was done from the month of March to May and species identification was done after each collection of trapped fruit flies.

2.1. Preparation of trap body

Fruit fly traps were fabricated from one litre plastic water bottles. One litre empty water bottles were taken and the wrapper was removed. Three windows of size 1"x1"x1" was made with a sharp blade or knife at 3 inches from top. A small hole was made in the centre of the cap with needle. A thin flexible wire of 10 inches length was taken and a knot was made at the centre, the wire was inserted from inside to outside the cap and a loop was made for hanging the bottle and other end was used for tying lure inside the bottle. For preparation of lure wick or base half inch thick cotton rope available in the market was procured and used. The cotton rope was cut in to 2 inches length and the cut ends were tied with thin copper wire to secure the rope intact.

2.2. Preparation of para-pheromone lure

For preparation of lures, ethyl alcohol 99.9% AR, methyl eugenol and malathion 50% EC were used in the ratio of 6:4:2. Each cotton rope lure wick requires approximately 4ml of solution. Accordingly based on the number of lures required, required quantity of solution was prepared in a glass or plastic container with lid facility. The cotton rope bits were soaked in the prepared solution for 24 hours for complete absorption of solution. The container was closed air tight to avoid evaporation of solution. After 24 hours, the individual lure was wrapped with aluminium foil for storage and future use. Enough care was taken to wear face mask and gloves while preparation and handling of para pheromone lures.

2.3. Field placement and observations

In the mango orchards 10 traps per acre were placed at uniform distance to cover entire orchard. The traps with lure were placed at 1.5 to 2 metre height in the mango trees. Observations were taken on weekly basis during the fruiting period from March to May and harvesting was done during the first week of June. During each observation the bottles were emptied and flies trapped were counted and recorded. The collected fruit flies were stored in vials and brought to Pest Detection Laboratory of National Institute of Plant Health Management, Hyderabad for identification. Identification was done using available taxonomic keys and species descriptions [5] and also using Australian Handbook for the identification of fruit flies [2].

3. Results and Discussion

3.1. Fruit flies in mango varieties

The number of fruit flies trapped in Dasherri, Himayat and Banginapalli mango varieties during the year 2018 and 2019 is presented in Fig. 1. The results obtained revealed that the traps placed in Banginapalli variety orchard recorded highest number of fruit flies in both years when compared to other two varieties Dasherri and Himayat. There was significantly higher number of fruit flies trapped in Banginapalli variety 190.60 ± 12.51 during the year 2018 and 90.80 ± 15.81 during the year 2019. However significantly lesser number of fruit flies were trapped in other two varieties, Dasherri (67.20 ± 3.77 during 2018 and 31.50 ± 4.75 during 2019) and Himayat (62.60 ± 5.99 during 2018 and 20.20 ± 4.26 during 2019) when compared to Banginapalli variety. The results obtained are in line with the previous findings reported in Karnataka that the highest number of fruit flies were trapped in Mallika variety followed by Banginapalli variety with the mean trap catches of 22.38 and 18.65 fruit flies / trap / week, respectively [13] and least trapping in Alphonso variety. The present results are also in line with the findings that fruit fly infestation were significantly higher in cultivar Banganpalli and Totapuri [20]. There was slow development of number of population of *B. dorsalis* from the month of March and peak population was recorded during May month. The earlier report that *B. dorsalis* is active throughout the year in southern part of India and increases especially when the minimum temperature increases during summer strengthen this outcome [19].

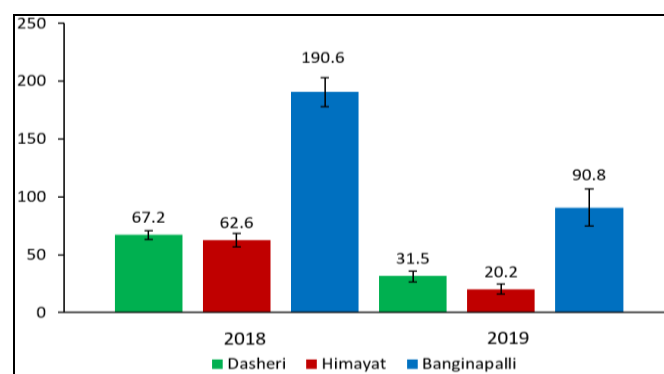


Fig 1: Mean number of fruit flies trapped in different varieties of mango during the year 2018 and 2019

3.2. Species level fruit flies in mango varieties

The fruit flies trapped in all the three varieties of mango

during the year 2018 and 2019 were identified for its species and the results obtained are presented in Table 1. The species level identification of trapped fruit flies revealed that among different fruit fly species that are damaging mango crop, only two species belong to genus *Bactrocera* were found during the year 2018 and 2019 in all the mango varieties studied. The two species observed in mango varieties at study location in Ranga Reddy district of Telangana State are the oriental fruit fly, *Bactrocera dorsalis* (Hendel) and the peach fruit fly, *Bactrocera zonata* (Saunders).

During the year 2018, in Banginapalli variety significantly high number of 115.40 ± 10.23 *B. dorsalis* was trapped whereas 75.20 ± 4.03 number of *B. zonata* only was trapped in the variety. The number *B. dorsalis* trapped in other two varieties, Dasherri (26.70 ± 1.59) and Himayat (23.80 ± 2.49) were significantly in lesser number as compared to Banginapalli variety. However, it was observed that *B. zonata* population found to be more in Dasherri (40.50 ± 2.88) and

Himayat (38.80 ± 3.67) compared to the population of *B. dorsalis* trapped in these two varieties (Dasherri - 26.70 ± 1.59 and Himayat - 23.80 ± 2.49). There was significant difference among the varieties with respect to the population of *B. dorsalis* and *B. zonata*. During the year 2019, the number of fruit flies trapped was lesser as compared to number of fruit flies trapped during the year 2018. However, the data recorded during the year 2019 showed similar trends of dominance of *B. zonata* species in Dasherri and Himayat varieties whereas there were almost equal mean number of *B. dorsalis* and *B. zonata* species in Banginapalli variety. In variety Banginapalli, a mean number of 45.90 ± 9.48 of *B. dorsalis* and 44.90 ± 7.18 of *B. zonata* were trapped. With reference to the other variety Dasherri, significantly higher number of *B. zonata* (20.50 ± 3.34) was recorded as compared to *B. dorsalis* (11.00 ± 1.57). Similarly the variety Himayat recorded significantly higher number of *B. zonata* (13.20 ± 2.68) as compared to *B. dorsalis* (7.00 ± 1.68).

Table 1: Number of fruit flies trapped in different mango varieties at species level

Mango varieties / Year / Species	Mean number of fruit flies trapped (March to May)			
	2018		2019	
	<i>Bactrocera dorsalis</i>	<i>Bactrocera zonata</i>	<i>Bactrocera dorsalis</i>	<i>Bactrocera zonata</i>
Dasherri	26.70 ± 1.59	40.50 ± 2.88	11.00 ± 1.57	20.50 ± 3.34
Himayat	23.80 ± 2.49	38.80 ± 3.67	7.00 ± 1.68	13.20 ± 2.68
Banginapalli	115.40 ± 10.23	75.20 ± 4.03	45.90 ± 9.48	44.90 ± 7.18
S.Em \pm	6.231	3.482	5.393	4.909
CD	18.656 **	10.427**	16.147**	14.697 **
CV %	35.629	21.383	80.062	29.245

CD – Critical Difference; S.E – Standard Error; CV – Coefficient of variation; ** $P < 0.01$

The results on species level fruit fly trapped in different varieties of mango gains support from the previous research reported by Verghese and Sudha Devi, 1998 that most common species of fruit fly infesting mango fruits are *Bactrocera dorsalis* (Hendel), *Bactrocera correcta* (Bezzi), *Bactrocera zonata* (Saunders). The previous research reports revealed that early cultivars and hybrids of mango were less susceptible to fruit fly infestation, mid maturing cultivars and hybrids were moderately susceptible and late-maturing cultivars and hybrids were most susceptible [3]. However the present study revealed that though Banginapalli is an early maturing variety had more mean number of fruit flies as compared to mid- season varieties like Dasherri and Himayat which infer that Banginapalli is more susceptible to fruit flies in the area of study. The lesser mean population of *B. dorsalis* in Dasherri variety observed in the present study is due to resistance character against this species and classified as resistant against *B. dorsalis* [4]. The previous reports on host plant resistance strengthens the present findings and opined that the rind hardness, height of small ridges, height of longitudinal ribs and pericarp thickness, which were significantly highest in resistant and lowest in susceptible genotypes, had a significant negative correlation with the percent fruit infestation in gourds [7, 8].

The study also revealed that with reference to species level population, *B. dorsalis* was trapped significantly higher number as compared to *B. zonata*. During the year 2018, *B. dorsalis* found dominating *B. zonata* in Banginapalli variety whereas *B. zonata* found dominating in other two varieties i.e., Dasherri and Himayat. Whereas during the year 2019, *B. Zonata* found dominating *B. dorsalis* in Dasherri and Himayat and almost equal population of both species was recorded in Banginapalli variety. All the varieties found to be affected by

both the species of fruit flies, however more trapping and higher number of fruit flies were trapped in Banginapalli variety which shows that the variety is more susceptible to both species of fruit flies as compared to Dasherri and Himayat varieties.

4. Conclusion

From the study, it was found that among different species of fruit flies found damaging mango fruits, only *B. dorsalis* and *B. zonata* were found present in Banginapalli, Himayat and Dasherri varieties in mango season of the year 2018 and 2019 in Ranga Reddy district of Telangana state. However, the number of flies trapped in mango varieties significantly different among the three varieties studied.

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