



SEASONAL MONITORING OF BACTROCERA SPP. THROUGH INSTALLATION OF METHYL EUGENOL TRAPS AT DIFFERENT HEIGHTS IN CHIKU ORCHARD

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Author's contribution

SRHC design the experiment, BKS gave the idea, FAS analysis the data, SS analysis the data statistically M.A.C finalized the result and BAB & QU help out in collection.

Key words:

B. zonata, Traps, Heights,

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ABSTRACT

The particular study was conducted on different heights during 2016-17. Two species were identified. The results indicated that the highest number of fruit flies 103.60 ± 24.75 *B. zonata* were recorded in the month of December 2016 at 2m height, whereas, the lowest number of flies captured 32.00 ± 6.44 on 1m height and optimum population observed at ground surface. Furthermore, results are showed during the month of January, less population captured as compared to month of December. The results discussed that the concentration of methyl eugenol was use equal in all the Traps and the males were equally attracted in all the traps but the difference in total number of Adults captured among the different traps was only due to the variations in number of heights, and abiotic factors respectively. On the other hand, data pertaining that *B. dorsalis* is was minimum observed as compared to *B. zonata* at all treatments as well as 2m height was found favorable as compared to other treatments with (max/min 31 to 27°C and 46 to 40% RH), respectively. The correlation was 0.78, 0.78, 0.75, 0.72 and 0.78 noted on both species and it is also interesting to note that abiotic factors had a reverse impact on male capture in per trap. However, the correlation with humidity was negatively related for all the treatments. But the significant effect of temperature on *B. dorsalis* is observed negatively ($p < 0.0001$).

1. INTRODUCTION

Sapota or Sapodilla (Forsberg) commonly known as “Chiku” belongs to family Sapotaceae it is a native of Mexico and spread to all over in the world [1]. Sapota is one of the important tropical fruit of different areas of the world. It is around cultivated on large scale in all provinces of Pakistan Sindh and Baluchistan is on the ranking and Punjab and KPK is in less in production. Pakistan possesses such variety of soil and climate where, all kinds of field and horticultural crops can be grown among horticultural crops fruits are of immense importance because of their economic value and returns

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[2]. Fruits are also important due to their nutritional value and are relatively an expensive source of protein, mineral, sugar & vitamins. Besides fruit are utilized in preparation of pickles, jam, jelly, curries, candies, etc. Their use is recommended for curing blood diseases, rheumatism, diabetes, etc. [3]. In India, the total area under fruit cultivation is 5.5 million hectares with an approximate yield of 58.74 million tons, which accounts for 11 percent of the world total production after India Pakistan is the second largest producer of mango, banana and sapota about 39.5 percent of the world's mango and 23 percent of world's banana, are produced in India [4]. The major states producing fruits are Uttar Pradesh, Andhra Pradesh, Bihar, Gujarat, Maharashtra, Karnataka and Punjab. The area

under fruit crops is 2.90 hectares with a production of 46, 90,504 tons. Mango, sapota, banana and guava are grown mostly in Sindh and Panjab, among the various fruits mango, sapota and banana cover 86504 hectares i.e. 30 percent of total area covered under these crops [5]. Tephritidae (Diptera) are one of the most fascinating and diversified. They are commonly called as "fruit flies" or "orchard flies" due to their close association with fruits. These flies are also referred to as 'Peacock flies' due to their habit of strutting and vibrating their wings. There are over 4000 species of fruit flies in the world [6]. From them about 5 percent occur in India [7]. This family is represented in the entire world region except Antarctica. The oriental region comprises nearly 1000 species so far recorded [8]. The genera *Dacus* and *Bactrocera* are important as they include economically important species such as *B. dorsalis* (Hendel) and *B. zonata* (Saunders). The subgenus *zeugodacus* include economically important species like *B. cucurbitae* nearly 35 percent of the known fruit fly species attack soft fruits like mango, guava, sapota, citrus, ber, peach, etc and several cucurbitaceous vegetables [9]. The present need as well as that of future would be achieving production and nutritional security in a sustainable way without harming the environment there is urgent need to adopt eco-friendly technologies to enhance productivity of fruits and vegetables [10]. The use of chemical attractant like methyl eugenol along with appropriate trapping technique has also been found effective in monitoring, suppressing fruit flies on large areas by male annihilation technique (MAT) and even complete eradication of various fruit flies [11]. They have great economic significance in Pakistan due to their heavy losses to fruits at the farm level with estimated loss of 200 million US dollar annually and the small farmers suffer in particular, being the main growers of highly susceptible guava, mango, peach and cucurbits are being unable to afford existing protection measures [12]. The main objectives of the study were to monitor *Bactrocera* spp. population in chiku orchard and examine the effect of temperature and humidity on different height of traps.

2. MATERIALS AND METHODS

2.1 Experimental Site

The experiment was conducted during the year 2016-2017 for the monitoring of *Bactrocera* spp. on an area of 10 acres of chiku, orchard at Horticulture Garden Sindh Agriculture University Tando Jam Sindh Pakistan. The male adult populations of fruit flies were recorded weekly basis through pheromone trap baited with lure toxicant mixture (85% methyl eugenol+10% sugar+5% thiodan insecticide).

2.2 Experimental Design

There were four treatments. The experiment was laid out in a Randomized Complete Block Design (RCBD). The

entire experiment was completed in laboratory conditions for observing the fruit flies catches by hanging fruit fly traps at different heights on chiku trees. The experiment was replicated five times. The pheromone traps were replenished after 15 days to keep fresh chemical for attraction of fruit flies and killed male flies in traps were counted and species identified at weekly interval. The collected data was statically analyzed using Statistix 8.1 version.

Treatments:

- T1 = Pheromone traps installed on the ground surface
- T2 = Pheromone traps installed at 1metres height
- T3 = Pheromone traps installed at 2metres height
- T4 = Pheromone traps installed at 3metres height

3. RESULTS

3.1 Trapping efficiency of different treatments against *Bactrocera zonata*

According to the results of Table 1 maximum number of *B. zonata* population were trapped during the month of April 2017 whereas the minimum were recorded in the month of January 2018 followed by February and March 16.6 ± 2.18 , 46.07 ± 3.99 . Similar observation was made by [13] studied that the population dynamics of fruit fly maximum activity (172.1 flies per trap) was found during March to April. However, [14] also observed that the minimum number of flies noted in January respectively. In the present study month of December also examined highest number of *B. zonata* recorded in T3 at 2m height 103.60 ± 24.75 moreover lowest population were observed T2 1m 32.00 ± 6.44 , followed by T1 0m and T4 3m. Further result was in accordance with the observations of [15] who have reported that the highest *B. zonata* catches (1428.4 ± 260.04) were monitored in traps installed at 2m height; while the monthly *B. zonata* trap catches simultaneously decreased to 1340.5 ± 230.02 , 1185.4 ± 202.56 and 1177.3 ± 210.23 at trap heights of 0m (surface), 1m and 3m, respectively. The present result further showed that during the month of January, March and April maximum adults noted (Max, min 22 ± 19 °C and $51 \pm 67\%$ RH), as well as found significantly ($P < 0.05$) less population as compared to month of December. In that order, [16] observed the population dynamics of fruit flies annual trap captures showed an increase with a peak in May to July but then declined in November a daily average temperature of 18°C was estimated as the threshold temperature for the flies to undertake long-range dispersal. The further results are summarized in Table 2 that monthly wise highest number of *B. dorsalis* adult's recorded (58.75 ± 4.35) during the month of April on the other hand, minimum (3.6 ± 1.14) in the month of January followed by December, March and February. Similarly to the present result, [17] examined the development *B. dorsalis* maggots took 6 days in September, 29 days in December- January and 12 days in

Seasonal monitoring of *Bactrocera* spp. through Methyl eugenol traps

April amongst mango, guava and sapota. The present results discussed that the concentration of methyl eugenol was use equal in all the traps and the males were equally attracted in all the traps but the difference in total number of Adults captured among the different traps was only due to the variations in number of heights, and abiotic factors. Present results are in conformity by [18] who evaluated that at-minimum 176spp of *Bactrocera* are attracted to traps and more than 58 of ME attracts only adult males of *Bactrocera* species up to 500m. It is more correctly called methyl eugenol, and chemically it is 4-allyl-1, 2-dimethoxybenzene. While, 1 percent methyl eugenol along with 0.5 percent Malathion or 0.1 percent carbaryl was most effective against *B. dorsalis*. As well as another researcher [19] found that the Methyl eugenol is the most powerful of all the male lures attracting usually the males of Oriental fruit fly and others and is being used for both monitoring and management of fruit flies, this technique has been successfully used for the eradication and control of several *Bactrocera*spp. The present findings also revealed that maximum number of flies collected T3 which followed by T4, T1 and T2 respectively. But unfortunately in March population increasing gradually in all treatments highest density of *Bactrocera* species were noted in at 2m whereas, lowest was observed at 1m followed by 3m 0m.

3.2 Correlation between Temperature, Humidity, and wind against *Bactrocera* species

The observations on the impact of different abiotic factors revealed that there was no consistent correlation between the male capture. However, Table-3 indicated that there was a significant effect of temperatures on catching efficiency of all the treatment ($p < 0.0004$). This investigation also obtained by [20] whom record significant positive correlation between trap catches of *B. dorsalis* and *B. zonata* in guava with maximum and

minimum temperature. However, the maximum catches of *Bactrocera dorsalis* and *Bactrocera zonata* in mango orchard were 98.6 to 62.6 fruit flies during 30th and 27th standard weeks in 1992 and 1993 respectively. Accordingly to another researcher [21] reported that the temperature plays a vital role in development, survival and reproduction of *Bactrocera*spp. and other insects it is also known to be a very significant role of temperature influence progress of insects and relationship between them time and duration population some time ups some time down because of factor affecting on it in the field which was similar to the findings of present study. Furthermore, the result examined a strong relationship between temperature and trapped flies. The correlation for T1, T2, T3, and T4 was 0.78, 0.78, 0.75, and 0.72 respectively. It is interesting to note that (Max\Min) temperature, wind velocity, evaporation and relative humidity had a reverse impact on male capture in per trap. Present results were corroborated with the results of [22] that noted that the *B. dorsalis* in guava had observed that minimum temperature correlated positively and morning and afternoon relative humidity, but had maximum temperature correlated significantly negative effect and various workers indicated that the population fluctuation of fruit flies was dependent on the availability of the host crops. On the other hand, the correlation with humidity was negatively related for all the treatments which were; T1 (-0.43), T2 (-0.43), T3 (-0.41), and T4 (-0.40). The effect of wind speed on *Bactrocera zonata* collection was positive. But the significant effect of temperature on *Bactrocera dorsalis* was observed negatively ($p < 0.0001$). On the other hand, Statistical analysis on effect of wind on overall collection of *Bactrocera dorsalis* was negative and non-significant. These results are totally disagreed by [23] whom investigated about significant positive correlation of the trap catches of *B. dorsalis* in mango with minimum temperature and wind speed.

Table 1: Population of *Bactrocera zonata* captured in methyl eugenol trap at various heights

Treatments	December	January	February	March	April	Average
T1 Ground Surface	62.00±14.37b	7.400±1.66ab	13.80±1.31bc	51.40±5.08 ^b	110.80±6.12b	62.4±5.70
T2 1m height	32.00±6.44b	6.400±0.92b	7.400±1.50cd	21.80±3.55c	72.80±9.03c	28.8±4.28
T3 2m height	103.60±24.75a	10.00±1.61a	40.20±5.26a	91.40±4.27a	185.80±18.76a	86.2±10.9
T4 3m height	37.40±5.83b	5.00±0.63b	5.00±0.63d	22.20±3.05c	37.80±4.81d	21.4±2.9
Mean	58.75±12.84	7.2±1.45	16.6±2.18	46.07±3.99	101.08±9.68	

Table 2. Population of *Bactrocera dorsalis* captured in methyl eugenol trap at various height

Treatments	December	January	February	March	April	Mean
T1 Ground Surface	35.00±14.14ab	4.200±1.24ab	4.200±1.24b	35.80±3.63b	70.40±8.04b	29.92±5.65
T2 1m height	24.40±6.01b	2.400±0.92b	1.600±0.92b	11.20±3.42c	35.20±0.17c	14.96±2.28
T3 2m height	52.00±12.70a	5.800±1.52a	10.80±1.31a	56.00±6.95a	104.00±6.18a	45.72±5.73
T4 3m height	23.60±5.65b	2.200±0.86b	2.200±0.86b	11.20±3.80c	25.40±2.99c	12.92±2.83
Average	33.75±9.62	3.6±1.14	4.07±1.09	28.55±4.45	58.75±4.35	

Table 3. Correlation between captured males of *Bactrocera* spp. per trap and different abiotic factors on Chiku

Treatments	T1	T2	T3	T4
Temp	0.7802	0.7870	0.7565	0.7280
	0.0004*	0.0003*	0.0003*	0.0003*
Humidity	-0.4360	-0.4365	-0.4194	-0.4006
	0.0914	0.0910	0.1058	0.0959
Wind Speed	0.5383	0.5439	0.5440	0.5563
	0.0315*	0.0294*	0.0294*	0.0286*

4. DISCUSSION

Diversity of flora and fauna is the gift of nature. An area or region rich in plant and animal diversity is considered blessing for their residents. Insect fauna in this connection is also has its own significance in nature. It is due to the importance of insect as pest, pollinator, biocontrol agent, and decomposer, source of food (Honey), source of raw silk for textile industry and source of food for higher animals in food web. Human disturbance of nature ultimately effect insect fauna of

5. CONCLUSION

Present findings can be concluded that the methyl eugenol was the best to attract male flies along with sugar and Malathion insecticides. Further conclusion found the optimum temperature has positive impact of attraction ability on all the traps, whereas; highest humidity was negatively related with adult population.

6. RECOMMENDATIONS

Methyl eugenol trap has been found to be the most powerful male lures for the males of *Bactrocera* spp. very affective to attract these fruit flies. It also suggested that ground surface and 2m height was the best to capture the maximum number of lies. The month of April to May found better for peak population as well as *Bactrocera zonata* was maximum observed as compare to *Bactrocera dorsalis*.

7. CONFLICT OF INTEREST

All authors have declared that there is no conflict of interest regarding publication of this article.

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Seasonal monitoring of *Bactrocera* spp. through Methyl eugenol traps

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