

## Efficacy on Population Dynamic of Fruit Fly, *Bactrocera* spp. (Tephritidae: Diptera)

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**ABSTRACT:** Efficacy on population dynamic of fruit fly, *Bactrocera* spp. (Tephritidae: Diptera) experiment conducted during rabi season 2019-2020 at the Agricultural Organic Research Farm Kargunwaji, Laboratory of Department of Entomology, Bundelkhand University, Jhansi (U.P.). A total number of four species of fruit flies like- *Bactrocera affinis*, *B. dorsalis* and *B. zonata* were trapped in methyl eugenol baited traps and only one species, *Bactrocera cucurbitae* was trapped in cue lure baited traps. The population range of *Bactrocera affinis* was recorded 85.6-321.0 FFs/trap/week, *B. cucurbitae* 106.4-682.76FFs/trap/week, *B. dorsalis* 33.6-129.56 FFs/trap/week and *B. zonata* was recorded 88.9-334.6FFs/trap/week, respectively. The population of *Bactrocera affinis*, *B. cucurbitae*, *B. dorsalis* and *B. zonata* was covered 12.7, 69.0, 5.1 and 13.2 per cent of total trapped population, respectively. *Bactrocera cucurbitae* was predominant species in cue lure and *B. zonata* in methyl eugenolbaited traps. The population of *B. dorsalis* was the lowest compared to all other flies. Its population recorded from 45<sup>th</sup> SW to 11<sup>th</sup> SW in the season is as follows 46.7, 49.2, 59.4, 70.3, 79.3, 89.6, 68.0, 56.7, 51.3, 39.9, 33.6, 35.8, 42.1, 56.2, 66.5, 90.1, 102.5, 116.5 and 129.5 FFs/trap/week, respectively.

**Keywords:** Cure lure, fruit flies, methyl eugenol, population dynamic, traps

### INTRODUCTION

The flies belonging to the families Drosophilidae and Tephritidae are together known as fruit flies. The flies of family Tephritidae are sometimes called the 'true fruit flies'. These flies occupy an important place in the list of enemies of plants. Fruit flies are quarantine pest and their control is difficult. Fruit flies are the major pests of fruits, vegetables, and ornamental plants. The thirty five percent of the known fruit fly species are responsible for the attacked on the soft fruits and vegetables, including mango, guava, citrus, ber, peach and cucurbitaceous vegetables in India (Farman Ullah *et al.*, 2017). The variations in the abiotic factors are playing a vital role on the species complex and its population dynamics (Vignesh *et al.*, 2020). They have great impact on agriculture and the economy of many countries as they attack a number of plant species and cause enormous damage to fruits, vegetables and flower heads. Out of nearly 4,400 species of fruit flies distributed throughout the world (Norrbon, 2004). 250 species are of economic importance and are distributed widely in temperate and sub-tropical regions of the world (Christenson and Foote 1960), but the greatest

diversity of species occur in the tropical regions (Norrbon *et al.*, 1998). Habitats they occupy range from rainforest through to open grassland and suburbia (Michaux and White 1999). More than 200 species of fruit flies have been reported from India, however, majority of them have no economic importance (Madhura and Verghese 2003). The fruit fly species which are serious pests of Agriculture throughout the world belongs to genera *viz.*, Anastrepha, Bactrocera, Ceratitis, Dacus, Rhagoletis and Toxotrypana (Harold, 2001). The major economically important species of fruit flies are *Bactrocera cucurbitae*, *B. dorsalis*, *B. zonata* and *B. correcta*. Among these *B. dorsalis*, *B. zonata* and *B. correcta* infest mango and guava (Verghese and Devi 1998) and *B. cucurbitae* infests cucurbitaceous vegetables (Atwal and Dhaliwal 2002). Female fruit flies have an ovipositor, similar to the 'sting' of a wasp, with which they puncture the skin of healthy fruits and flowers into which the eggs are laid (Marc *et al.*, 2010). Maggots come out from these eggs, pollute and destroy fruits by feeding on the pulp. In melons the infestation of pest often reaches per cent causing total loss to the farmers. Other cucurbitaceous fruits may also be infested up to 50 per cent (Atwal and

Dhaliwal 2002). Biotic factors viz., parasites, predators, host plant resistance and abiotic factors viz., temperature, rainfall, humidity and sunshine hours play an important role in regulation of the pest population. The population dynamics in relation to these factors provides some useful and important information for determining the real situations responsible for seasonal abundance and outbreak of the pest under the existing ecological conditions. Para-pheromones viz., methyl eugenol and cue-lure are good male attractants and play an important role both in monitoring and management of fruit flies. Shukla and Mishra (2005) recommended hanging of traps baited with wooden blocks soaked in ethanol, methyl eugenol and malathion (6:4:1) @ 10 traps/ha in mango orchards during fruiting period i.e. from April to August for the management of *B. dorsalis* and *B. zonata*. Several efforts have been made in India and abroad to assess the relative performance of traps baited with Para-Pheromones and to work out the species variation in fruit flies but information on these aspects in this part of U.P are quite meagre or scanty.

## MATERIALS AND METHODS

Efficacy on population dynamic of fruit fly, *Bactrocera* spp. (Tephritidae: Diptera) experiment conducted during *rabi* season 2019-2020 at the Agricultural Organic Research Farm Kargunwaji, Laboratory of Department of Entomology, Bundelkhand University, Jhansi (U.P.).

**Climatic conditions:** The present experimental sites are located in the main campus of Bundelkhand University at Jhansi. Geographical situation of Jhansi district lies between 25° 27' north altitude and 78°35' east longitude, on altitude of 217 meters above the sea level in the eastern Uttar Pradesh, India. The Jhansi district falls in semiarid-zone, receiving a mean annual rainfall of above 1200-1400mm, in which about 287-309mm of the total precipitation occurs during monsoon season, July to end of September, with a few showers in winter. The winter months are cold and occasionally frost occurs during this period. The summer months are hot and dry.

**Population dynamics of fruit-flies:** The experiment was conducted in RBD with six treatment and five replicating. A total of 30 traps of three types were used during the study. These include 10 Bottle fruit fly (BFFT), 10 McPhail fruit fly trap (MPFFT) and 10 Param fruit fly trap (PFFT). Two types of parapherom on methyl eugenol (ME) and cue lure (CL) were used. methyl eugenol was used in 5 traps of each type and cue lure in the other 5. The traps were installed during first week of November, 2019 to second week of March 2020. A distance of 20 m was maintained between each treatment. The traps were hung with help of string on the bamboo poles at Organic Research Farm Kargunwaji Jhansi. String of each trap was greased as and when required to keep ants away from traps and to save the trap fruit flies from them.

## RESULTS AND DISCUSSION

Result of investigations on “Study on Population Dynamic of Fruit fly, *Bactrocera* spp. (Tephritidae: Diptera) and Species Diversity” carried out at the Organic Research Farm Kargunwaji, Jhansi and in the Laboratory of the Department of Entomology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi, Uttar Pradesh during the years 2019-20 and have been presented below:

**1. Population dynamics of fruit flies trapped in ME and CL baited traps.** Observation to be recorded on adult population of fruit fly, *Bactrocera* spp. from 45<sup>th</sup> standard week (SW) of 2019 to 11<sup>th</sup> SW of 2020 revealed that flies began to attract towards traps from the week they were installed. The population of flies trapped in Bottle fruit fly traps, McPhail Fruit fly traps and Param Fruit Fly traps baited with Methyl Eugenol (ME) and Cue-Lure (CL).

**Table 1: Fruit fly species trapped in para-pheromons baited traps.**

Sr. No.	Name of species
Cue lure (CL)	
1.	<i>Bactrocera cucurbitae</i>
Methyl eugenol (ME)	
1.	<i>Bactrocera affinis</i>
2.	<i>Bactrocera dorsata</i>
3.	<i>Bactrocera zonata</i>

A total of four species of fruit fly were recorded during the study period in which one species of fruit fly, *Bactrocera cucurbitae* was attracted in cue lure (CL) baited traps and three species viz., *B. affinis*, *B. dorsalis* and *B. zonata* were trapped in methyl eugenol baited traps. Fruit fly species viz., *Bactrocera affinis*, *B. correcta*, *B. diversa*, *B. dorsalis* and *B. zonata* recorded in present study in ME baited traps were also recorded earlier (Singh *et al.*, 2007), hence confirm our finding. In ME baited traps five fruit fly species viz., *Bactrocera affinis*, *B. correcta*, *B. diversa*, *B. dorsalis* and *B. zonata* recorded in present study had also been reported by earlier workers (Singh, *et al.*, 2007; Pal *et al.*, 2012a). *Bactrocera cucurbitae* found predominant species of fruit fly in present studies had also been reported major species of this area and confirm our result (Pal *et al.*, 2012-c).

Data was recorded on population dynamics of *Bactrocera affinis*. This species was active throughout the season during study period and attractive in methyl eugenol baited traps. The population of *Bactrocera affinis* was started from 45<sup>th</sup> SW and at that time it was 115.1 FFs/trap/week which was recorded in an increasing order up to 50<sup>th</sup> SW but after that its population was found to be decreasing by 3<sup>rd</sup> SW. Its population was seen again in increasing order after 3<sup>rd</sup> SW and by the end of the season. The peak population was seen in 11<sup>th</sup> SW and at that time it was 321.0 FFs/trap/week. Its contribution in the entire population of flies was (12.7 per cent, Table 3) which was on third position in the table.

**Table 2: Population dynamics of trapped fruit flies, *Bactrocera* spp. I pheromones baited traps in during 2019-20.**

SW	Mean population			
	<i>B. affinis</i>	<i>B. cucurbitae</i>	<i>B. dorsalis</i>	<i>B. zonata</i>
45	115.1	346.0	46.7	120.1
46	120.8	406.7	49.2	126.0
47	147.7	387.4	59.4	153.9
48	174.7	287.4	70.3	182.0
49	198.3	265.0	79.3	206.4
50	224.7	183.3	89.6	233.8
51	171.7	160.4	68.0	178.3
52	143.4	151.0	56.7	148.9
1	129.3	126.6	51.3	134.5
2	101.6	114.4	39.9	105.6
3	85.6	106.4	33.6	88.9
4	89.2	157.3	35.8	93.0
5	104.2	230.6	42.1	108.7
6	138.0	288.4	56.2	144.0
7	164.8	321.9	66.5	171.9
8	222.7	426.6	90.1	232.2
9	253.8	556.3	102.5	264.7
10	289.1	610.0	116.5	301.4
11	321.0	681.7	129.5	334.6

*Bactrocera cucurbitae* was most active species and trapped in cue lure baited traps. The population was the highest in comparison to all other species of fruit fly. Its population range was recorded from 106.4-681.0 FFs/trap/week in the entire season. In the first week of season it was 346.0 FFs/trap/week while in the last week of the season it was recorded on peak.

The population had noticed a decline during the winter week, which was the lowest in the month of January. It was predominant species of fruit fly during the study period. Its contribution in the entire population of flies was highest (69.0 per cent) which was on first position in the Table 2. Pal *et al.* (2012a) observed of its range mean population (0.05-15.42 FFs/trap/week) during summer season of this species during summer season. Pankaj *et al.* (2002) recorded the minimum (0.67 fruit fly /trap) and maximum (2.83 fruit flies/trap) population of this species, respectively in 21<sup>st</sup> and 27<sup>th</sup> SWs while Manzar and Shrivastava (2004) reported minimum and maximum population, respectively, 297.3 and 396.6

fruit flies/trap in 23<sup>rd</sup> SW in 2002 and 20<sup>th</sup> SW in 2003. The population of *B. dorsalis* was the lowest compared to all other flies. Its population recorded from 45<sup>th</sup> SW to 11<sup>th</sup> SW in the season is as follows 46.7, 49.2, 59.4, 70.3, 79.3, 89.6, 68.0, 56.7, 51.3, 39.9, 33.6, 35.8, 42.1, 56.2, 66.5, 90.1, 102.5, 116.5 and 129.5 FFs/trap/week, respectively. Its contribution in the entire population of flies was lowest (5.1 per cent) which was on fourth position in the Table 3. Deepa *et al.* (2009) reported peak population of this species in 4<sup>th</sup> week (17<sup>th</sup> SW) of April 2006 and 2007 from Kanpur while Gupta *et al.* (1990) found its peak activity in 3<sup>rd</sup> week of June (25<sup>th</sup> SW) on apricot, 4<sup>th</sup> week of June (26<sup>th</sup> SW) on plum and 2<sup>nd</sup> week of July (28<sup>th</sup> SW) on peach in the mid-hill region of Himachal Pradesh. Difference in our findings and that of earlier workers may be due to variation in availability of suitable hosts and in abiotic parameters prevailing at places of studies. Different result were reported by Pal *et al.* (2012-a), who have not observed of this species in summer season.

**Table 3: Contribution of fruit fly species to trapped population during 2019-20.**

	<i>B. affinis</i>	<i>B. cucurbitae</i>	<i>B. dorsalis</i>	<i>B. zonata</i>	Grant population
Total number of specimens	3196	17422	1282	3332	25232
Contribution in per cent	12.7	69.0	5.1	13.2	100

The population of *B. zonata* was seen to be almost equal to the *B. affinis*. Its population was started with 120.1 FFs/trap/week and reaching 233.8 FFs/trap/week in 50<sup>th</sup> SW but after that it started decreasing and at 3<sup>rd</sup> SW it reached the lowest level. The population began to increase in February and it was found to be the most in the last week of the season. The population range was 88.9-334.6 FFs/trap/week. It was second dominant species of fruit fly during the study period. Its contribution in the entire population of flies was 13.2 per cent which was on second position in the table. Pal

*et al.* (2012a) observed of its peak population (1226.33 FFs/trap/week in 20<sup>th</sup> SW) during summer season of this species during summer season. Manzar and Srivastava (2004) recorded maximum population of 395.6 fruit flies /trap in 23<sup>rd</sup> SW during 2002 and 432.3 fruit flies/trap in 20<sup>th</sup> SW during 2003 in Kanpur while Deepa *et al.* (2009) working in above area observed its peak activity in 42<sup>nd</sup> SW of 2006 and 10<sup>th</sup> SW of 2007.

### CONCLUSION

- A total of four species of fruit fly were trapped in

para-pheromon baitedtraps.

- *Bactrocera affinis*, *B. dorsalis* and *B. zonata* were trapped in methyl eugenol baited traps while only one species, *Bactrocera cucurbitae* was trapped in cue lure baitedtraps.

- The maximum population of *Bactrocera affinis* was observed 321.0 FFs/trap/week at 11<sup>th</sup> SW while minimum population was recorded at 3<sup>rd</sup> SW with 85.6FFs/trap/week.

- *Bactrocera cucurbitae* population range was recorded as 106.4 682.7FFs/trap/week during study.

- *Bactrocera dorsalis* population was on peak at 11<sup>th</sup> SW and population range was noticed 33.6-129.5FFs/trap/week.

- The population of *Bactrocera zonata* was lowest during January month and it peak population (334.6 FFs/trap/week) was recorded at last week of season.

- *Bactrocera affinis* was covered 12.7 per cent of the total trapped fly population.

- *Bactrocera cucurbitae* was covered 69.0 per cent of the total trapped fly population.

- *Bactrocera zonata* was covered 13.2 per cent of the total trapped fly population.

- *Bactrocera cucurbitae* was predominant species of fruit fly during study.

- *Bactrocera zonata* was predominant species comparison to *B. affinis* and *B. dorsalis* of fruit fly which were trapped in traps baited with methyl eugenol.

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**Conflict of Interest.** None.

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