

## Taxonomic fauna of genus *Bactrocera* (Fruit flies) attracted to Methyl eugenol and Cue lure traps in Peach orchard at District Dir lower of KPK, Pakistan.

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### Abstract

The present study was designed to identify the peach fruit flies of genus *Bactrocera* species and to find out their percentage of abundance, relative humidity (%) and temperature (°C) in a district Dir lower of KPK, Pakistan. The data were collected by using sex pheromones traps i.e. Me-methyl eugenol and cl-cue lure to attract the flies in June, July and August, 2021. With the help of sex pheromones traps, specimens of flies were collected from 7-localities of Dir lower district including Adenzai, Balambat, Khall, Lal qilla, Munda, Samar bagh and Timergara on weekly basis. From the collected specimens, total six peach fruit flies were reported in Dir lower with the help of Drew and Romig, 2013 literature and their taxonomic keys by comparing with already identified specimens named as *B. Zonata*, *B. Invadens*, *B. Cucurbitae*, *B. Dorsalis* complex, *B. Tau* and *B. Scutellaris* in the Agriculture research institute Mingora Swat. Temperature (°C) and relative humidity (%) were also recorded on weekly basis to check their relation with the *Bactrocera* species abundance. In treatment #1 group of me-methyl eugenol traps, total number of *Bactrocera* species were identified is 18374 in 14 weeks study duration. In total number of *Bactrocera* species, the percentages and numbers were 10552 (57.428%) of *B. Zonata*, 5550 (30.205%) of *B. Invadens*, 95 (0.517%) of *B. Cucurbitae*, 5550 (30.205%) of *B. Invadens*, 95 (0.517%) of *B. Cucurbitae*, 2176 (11.842%) of *B. Dorsalis* complex, 1 (0.005%) of *Bactrocera tau* and *Bactrocera scutellaris* identified. In me-methyl eugenol traps, *B. Zonata* were reported maximum (57.428%) and *B. Tau* were minimum (0.005%). In treatment # 2 group of cl-cue lure traps, the total number of *bactrocera* species were identified is 1667 in 14 weeks study duration;

in which the percentages and numbers were different such as 561 (33.653%) of *B. Zonata*, 205(12.297%) of *B. Invadens*, 793(47.570%) of *B. Cucurbitae*, 66(3.959%) of *B. Dorsalis* complex, 34(2.039%) of *B. Tau* and 2(0.01%) of *B. Scutellaris*. In cl-cue lure traps, *B. cucurbitae* were maximum (47.570%) and *B. Tau* were minimum (2.039%). The maximum number of species was reported at 23.1°C with 80% humidity and minimum numbers were recorded at 37.8°C with 32% humidity in me-methyl eugenol trap groups. In both trap groups, maximum number of species was reported at 23.1°C with 80% humidity and minimum numbers were recorded at 37.8°C with 32% humidity. This study proves that the efficacy of sex pheromone me-methyl eugenol is more than the cl-cue lure.

**Key words:** Fruit fly, Traps, Dir Lower

### Introduction

Globally, *Bactrocera* species are the important flies economically (Qin *et al.*, 2015). Numerous kinds of fruit flies species has been discovered worldwide with their host (Mun *et al.*, 2003). These species are found in all type of habitat in the world (Virgilio *et al.*, 2015; de meyer *et al.*, 2010); and are emerging pests that are increasingly playing role in the decay of fruit orchards. The decay due to these pests is driven by the changes in the climate. The climate change modifies the pest distribution ranges and increases the vulnerability of host plants for the pest's attacks. In addition to climate change, human movements, trading of living plants and fruits are increasing the threat of pest's outbreak to the new places; in the new places they can spread and establish their colonies (Nugnes *et al.*, 2018). Different species in *Bactrocera* genus has different species such as *Bactrocera macquart* has 400 species including pests that attacks on fruits and seed bearing organs, similarly *Bactrocera dorsalis complex* and *B. zonata* are highly polyphagous and are among the most alarming species that attacked on fruits and living plants. Due to their high polyphagous nature, they are the biggest threat to fruit orchards (Nugnes *et al.*, 2018). Most widespread and damaging *Bactrocera* species includes *B. Cucurbitae*, *B. Oleae*, and *B. Tryoni* which are mostly invasive and economically important (Jose *et al.*, 2013).

The evolutionary relationship of pests groups is important to understand for quarantine purpose and control (Jose *et al.*, 2013). Agricultural sectors development and progresses are important for food provision to countries and employment to people worldwide but insects pest are major hurdle in the progress of development because they are continuously damaging to food (Jaleel *et al.*, 2018). On the other hand, the protection and preservation of food crops is important

especially from *Bactrocera* flies in agricultural sectors for the development purpose. Integrated management systems to control the destruction due to these species are used now these days to get the maximum output from the crops (Jaleel *et al.*, 2013).

Economic losses come from the loss of trade between countries or regions to prevent the spread of these pests, management and eradication programs that include costs for surveillance and treatments, and significant crop losses where pests are present. (San jose *et al.*, 2018).

Morphological characteristics can be used differentiate genera from each other on the basis of abdominal terga fused versus not fused, shape of abdomen, scutellum and presence or absence of lateral and medial post-sutural vittae (San jose *et al.*, 2018). Fruit flies belong to the tephritids have usually colorful and intricate wing pattern and dacini species have large clear wings (San jose *et al.*, 2018). *Bactrocera* species like *B. dorsalis* and *B. Carambolae* are differentiated by their abdomen differences. A black T-pattern is present on abdomen of *B. dorsalis* and *B. carambolae* whereas the dark band is absent on the lateral side in terga of *B. dorsalis* but is more pronounced in *B. carambolae* form rectangle. Both species also differentiated by their wing characters. Likewise, *B. umbrosa* differentiate from other species by the black colored scutum with yellow stripes on the lateral sides and sutural vitae is absent on the scutum and more than one transverse band is present on the wing and abdomen is reddish brown.

The whole cycle complete in 16 days. To increase the survival rate of eggs in developed fruit, host must feed in all phases of the fruit fly life cycle. In the laboratory experiments, the pre-mating time lasted for 4 to 7 days and oviposition for 14 to 17 days. The mature larvae of fruit flies making one or two holes to come outside from fruit for pupation phase at depth 0.5 to 15 cm in soil (Dhillon *et al.*, 2005). The mature fruit fly is not sexually mature but under favorable condition, the fly gets their sexual maturity within 8 to 16 days to produce many progeny in a year. The adult fly feeds on honeydew, rotting plants, plants juices (Dhillon *et al.*, 2005).

Globally, flies different species are causing quantitative and qualitative loss of fruits and vegetables (Vasudha *et al.*, 2019). Those pest species have economic and ecological impression all over the world and their successful establishment depends on the abiotic and biotic elements which includes weather and specific biotic interactions (Davis, 2009; Mack *et al.*, 2000).

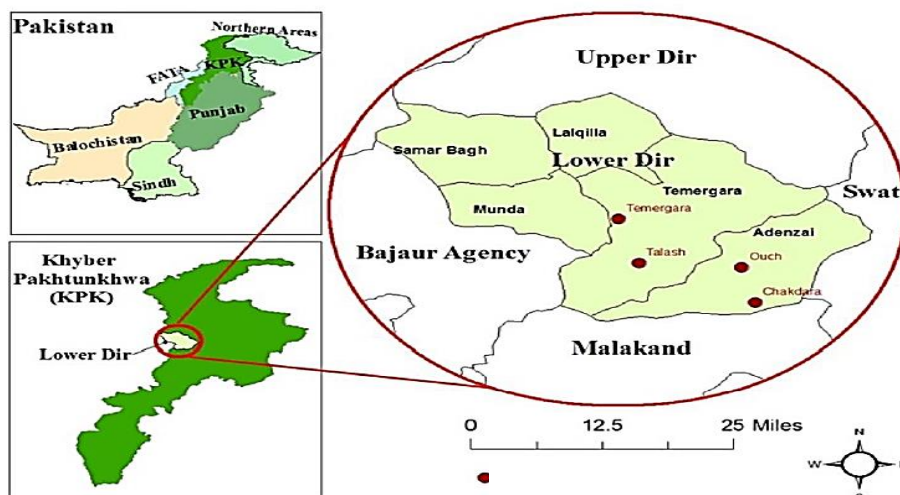
Pakistan is an agriculture country which has a lot of fruits and vegetables orchards. These species damage a lot of fruits, vegetables and other plants such are peach, guava, citrus, mangoes, and family cucurbitae. Majorities of the orchards in Malakand division including district lower Dir

and Swat are peach. Pest for peach fruits is genus *Bactrocera* which decrease yield product in a huge amount. Study was conducted on taxonomic fauna of genus *Bactrocera* attracted to methyl eugenol and cue lure traps in peach orchard at Dir lower KPK. So this study was conducted in order to study the taxonomy of fruit fly species under the genus *Bactrocera* specific to varieties of peach in district Dir lower. To evaluate efficiency of two pheromones traps of *Bactrocera* spp in peach orchards. To find out the number of *Bactrocera* spp in methyl eugenole and cue lure traps. To study relationship of relative humidity and temperature with species abundance.

## Materials and methods

### Study area

Study was conducted in peach orchards of district lower Dir Khyber Pukhtunkhwa, Pakistan district lower Dir lies between  $34^{\circ}50'43.19''$ n latitude and  $71^{\circ}54'16.43''$  e longitude, elevation is 1112m / 3648feet, barometric pressure is 89kpa, is a historical spectacular valley and also the part of PATA-provincially administrated tribal area and fata district of Malakand division placed 251.6 kilometer from Islamabad and 172.98 kilometer from Peshawar on the northern side of KPK.



Figur.1 map of district lower Dir, KPK. (Khan et al., 2020)

Host plant:

The specimens were collected from 20 peach orchards in seven different tehsil in district lower Dir including Adenzai, Balambat, Khall, Lal qilla , Munda, Samar bagh and Timergara.

### **Peach is a host of fruit fly:**

Cylindrical pheromones traps were used in the study. These traps were bottle like having holes on each side. The top diameter size of the trap is 13.5 centimeter, bottom diameter is 16 centimeter and length is 13.5 centimeter. 5ml me-methyl eugenol and 3ml lannate were inject into cotton swab inside the traps. In 20 peach orchards, 3 traps were set in one acre land of orchard. Total six cylindrical traps were installed at the height of 5.5 feet and at the distance of 90 feet from each other.

### **Meterallogical parameter:**

The relative temperature and humidity were noted on every week with the help digital hygrometer. Temperature and humidity are very important parameter for *Bactrocera* genus. With increase and decrease of humidity and temperature there is a fluctuation in abundance.

### **Data collection:**

The data were collected in summer season from June to August 2021. Fruit fly specimens were collected from peach orchards with the help of pheromones traps on weekly basis and were renewed. The exterminated fruit flies species were collected and counted separately from each cylindrical trap. After that all the species were set for pinning and transferred to lab for identification.

### **Taxonomic identification of fruit flies**

The specimen of *Bactrocera* was kept in a dry state until observation. Morphological identification was made under a stereoscopic (zeiss) microscope. Each specimen was identified morphologically in the entomology lab of agricultural research institute, Mingora, Swat. Specific identification was made by examining the fruit flies body parts and pictures were taken with the help of available literature, taxonomic keys of Drew and Romig, (2013) and by comparison with already identified specimen in the agriculture research institute Mingora Swat.

### **Photography**

Important body parts of genus *Bactrocera* like marks on wings, abdominal terga and face marks were observed. Photography was taken from adult specimens with the help of digital (axiocam) camera, which was attached with stereoscope (zeiss). Digital axiocam having 8mp and 4k

resolution with zeiss microscope provides the good quality images (8mp, 2017). Zeiss introduces the high quality cameras for good quality of images in microscopy. Zeiss cameras provide the best quality images for pathology, histology, and for other research work areas. ("zeiss axiocam", 2017)

### Pinning

All specimens was pinned and placed in a jar with naphthalene pellets. After pinning, proper labeling is necessary; which include locality, date of collection and collector's name.

### Data analysis:

Percentage of abundance was calculated by using the following formula. The data was also presented in the form of bar graph.

$$\text{Relative abundance (\%)} = \frac{\text{total number of individual species}}{\text{total number of species population}} \times 100$$

### Results

*Bactrocera* species were collected from peach orchards with the help of pheromones traps at district lower Dir, KPK and the taxonomy was studied in agriculture research institute, Mingora, Swat, KPK. On weekly basis, research work data were collected for 3 months duration from Jun to Aug 2021. For that purpose two types of pheromones were used, me-methyl eugenol and cl-cue lure, which fascinate merely male flies.

**Table (1) specific species of genus *Bactrocera* to peach fruit**

<b>Fruit flies spp</b>	<b>Peach host fruit</b>
<i>Bactrocera invedense</i>	+ve
<i>Bactrocera zonata</i>	+ve
<i>Bactrocera dorsalis</i>	+ve
<i>Bactrocera cucurbitae</i>	-ve
<i>Bactrocera tau</i>	-ve
<i>Bactrocera scutellaris</i>	-ve

\*+ve-sign represents presence and –ve-sign represents absence of specific species

### Adults of genus *Bactrocera*:

(a) *B. zonata (saunders)*:

Adult have a pair of medium size irregularly oval black spot in face; postpronotal lobes and notopleura yellow; scutum red-brown; mesopleural stripes; setae dorsally; scutellum yellow; legs- fulvous except hind tibiae fuscous to dark fuscous; wings with cells bc and c colourless, microtrichia in outer corner of cell c only, costal band very narrow and pale (fig 2a).

**(b) *B. invadense*:**

Adult have scutum with or without red-brown dark patterns. Abdominal terga iii-v with a distinct black T-pattern with or without lateral dark margins, lateral postsutural vittae very short and narrow (fig 2b).

**(c) *B. dorsalis* (oriental fruit fly):**

Adult have a pair of medium size black spots; postpronotal lobes and notopleura yellow; scutum black; mesopleural stripes, setae dorsally; lateral and medial postsutural yellow vittae absent; scutellum yellow; legs- fulvous except fore tibiae pale fuscous and hind tibiae fuscous; wings with cell bc and c colourless (fig 2c).

**(d) *B. cucurbitae* (melon fly):**

Adult have a pair of large black spots; postpronotal lobes and notopleura yellow; scutum red brown with or without irregular fuscous marking; mesopleural stripes, setae dorsally; two parallel sided lateral postsutural yellow vittae colourless present; scutellum yellow; legs- all segments fulvous except femora darker apically and hind tibiae fuscous; wings with cell bc and c colourless (fig 2d).

**(e) *B. tau* (walker):**

Adult have a pair of medium size oval black spots; postpronotal lobes and notopleura yellow; scutum black with red brown marking; mesopleural stripes, setae dorsally; lateral and medial postsutural yellow vittae colourless present; scutellum yellow; legs- generally fulvous except fore and hind tibiae; wings with cell bc and c (fig 2e).

**(f) *B. scutellaris* (bezzi):**

Adult scutellum yellow with a black apical spot; medial postsutural yellow vitta short and narrow; abdominal terga iii-v either entirely dark fuscous or each with a black T-pattern; mesopleural stripe equal in width to notopleuron dorsally (fig 2f).



**Figure.2** Adults of genus *Bactrocera* (a) *B. zonata*, (b) *B. invadense*, (c) *B. dorsalis*, (d) *B. cucurbitae* (e) *B. tau* and (f) *B. scutellaris*



Two different kinds of pheromones cylindrical traps named as me-methyl eugenol and cl-cue lure were mounted in peach cultivated area of lower Dir, KPK to observe their relative efficiency against fruit flies. Temperature, relative humidity and population data were recorded on weekly basis from week 1 to week 14 to know about the variation. In the first three weeks the temperature was approximately same but when the temperature increases gradually the number also increases. Temperature was directly proportional to number of *Bactrocera* genus. The figure 10 described the relative humidity fluctuation that is increased gradually on weekly basis. In the first week the relative humidity was low but increase gradually till 14 weeks, with increase in humidity the number of *Bactrocera* genus also increase. Humidity was directly proportional to number of *Bactrocera* genus.

### Treatment group of methyl eugenol traps:

The treatment groups details of me-methyl eugenol traps with their total species number, number of individual, percentage of abundance etc. Fig.3, 4, 5 shows the graphical details about the percentage of abundance of *Bactrocera* species in 1<sup>st</sup> treatment (T1) group of methyl eugenol. Treatment#1 (T1) group on the basis of three replication groups that are R1, R2 and R3 were plotted to check the percentage of abundance of each species separately in treatment#1-T1 group. In all 3 groups, the percentage of abundance of *B. zonata* and *B. invadens* were more than the other species. *B. dorsalis* was also present but in small percentage number while *B. tau* and *B. cucurbitae* were absent in me-methyl eugenole which is specific for these species as shown in Fig.3, 4, 5.

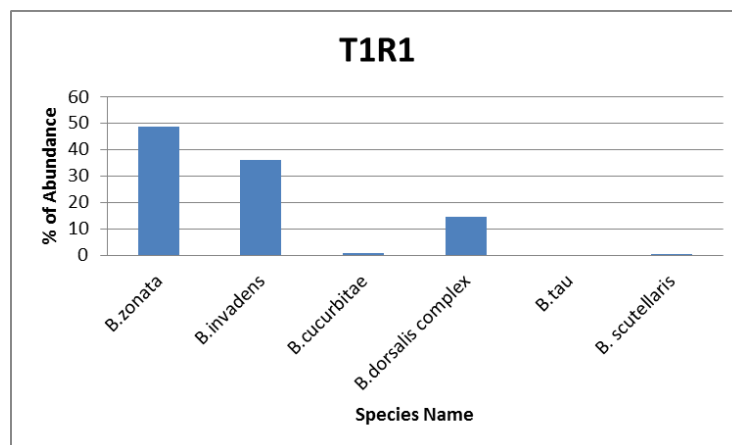


Figure.3 *Bactrocera* spp's, percentage of abundance in T1R1 treatment group.

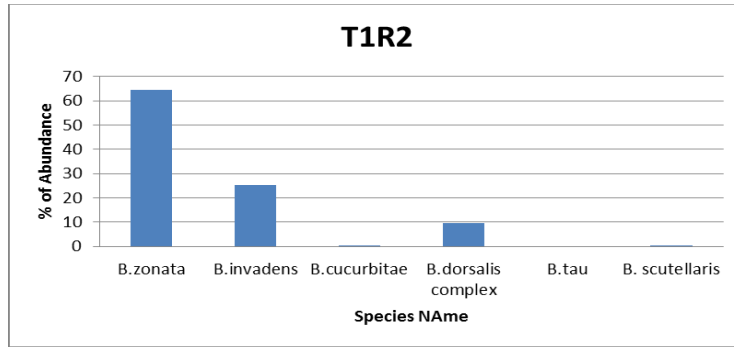


Figure.4 *Bactrocera* spp's, percentage of abundance in T1R2 treatment group.

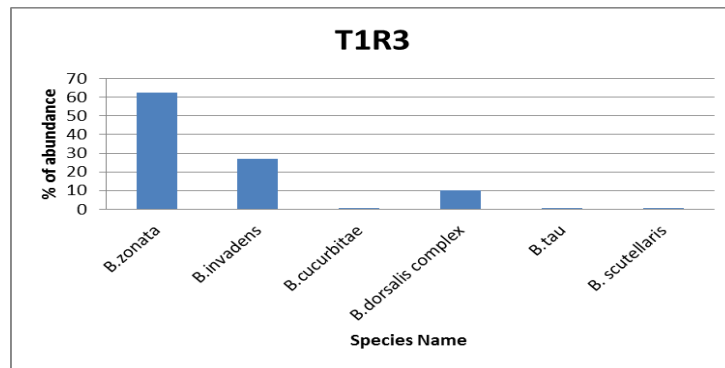


Figure.5 *Bactrocera* spp's, percentage of abundance in T1R3 treatment group.

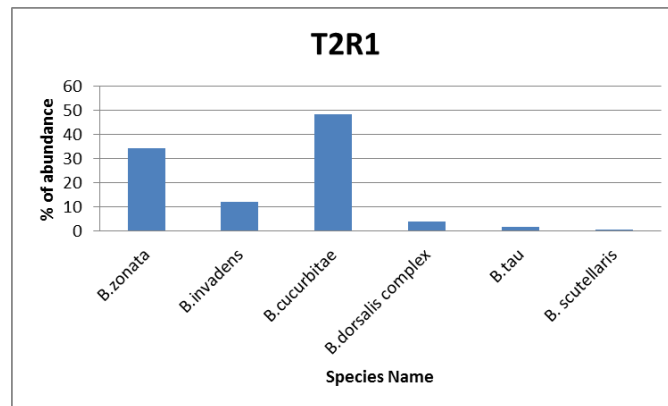


Figure.6 *Bactrocera* spp's, percentage of abundance in T2R1 treatment group

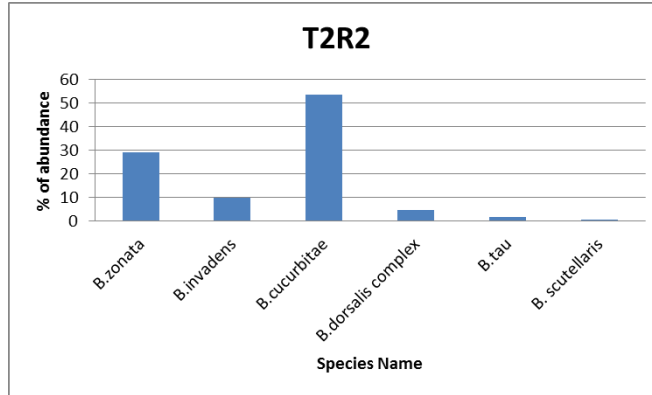


Figure.7 *Bacterocera* spp's, percentage of abundance in T2R2 treatment group

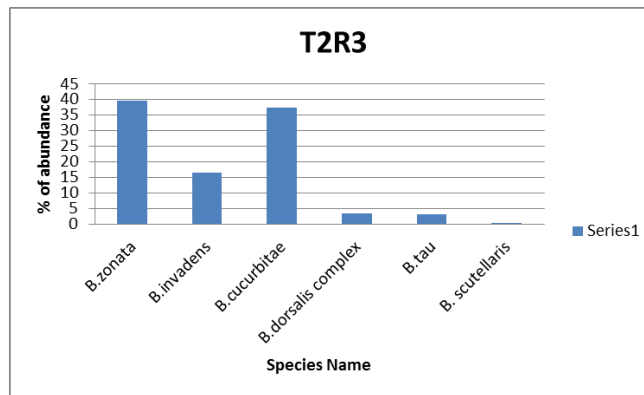


Figure.8 *Bacterocera* spp's, percentage of abundance in T2R3 treatment group.

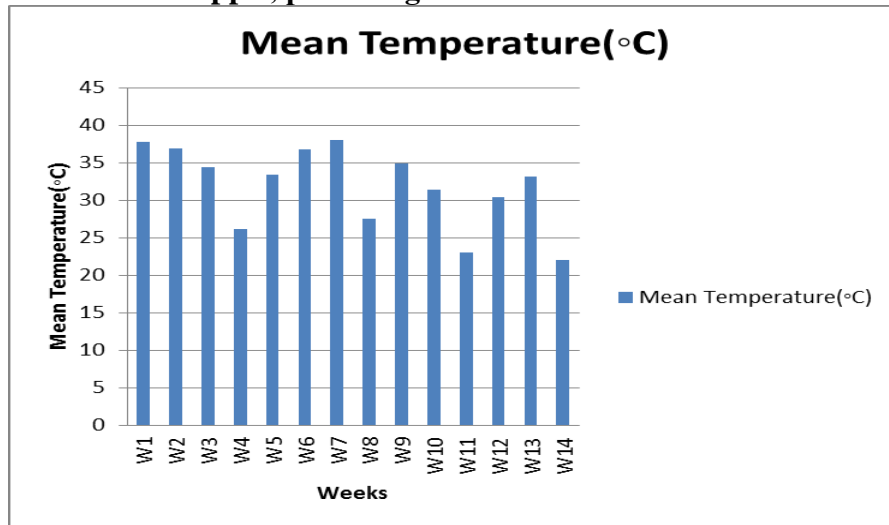
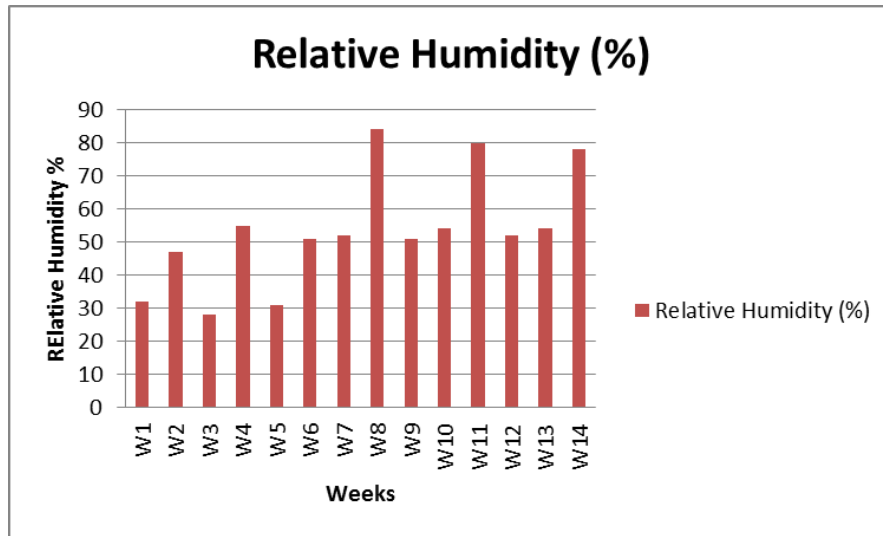


Figure 9 weekly data of mean temperature (°c)



**Figure.10 Weekly data of relative humidity %.**

#### **Treatment group of cue lure traps:**

The treatment group's details of cl-cue lure traps with their total species number, number of individual, percentage of abundance etc. Figure 6, 7, and 8 showed the graphical details about the percentage of abundance of *Bacterocera* species in 2<sup>nd</sup> treatment group of cue lure. Graphs of treatment 2 (T2) group on the basis of three replication groups that was R1, R2 and R3 were plotted to check the percentage of abundance of each species separately in treatment 2 (T2) group. In T2R1 and T2R2 groups, the percentage of abundance of *B.cucurbitae* was greater than other species. Meanwhile, *B. zonata* and *B.invadens*, *B. dorsalis complex* and *B. tau* were also found but the percentage of abundance was less because CL was specific for these species as shown in figure 6 and 7. In figure 8 that is T2R3 group, the %age of abundance of *b.cucurbitae* was more than the other remaining species.

Figures 9 to 10 have been showing the relationship of relative humidity and temperature with the species abundance. Both humidity and temperature have significant effect on abundance of *Bactrocera* spp's. Data regarding species abundance has been taken from week 1 to week 14 from methyl eugenol treatment group at different temperature and humidity. From week 1 to 6, more abundance of *B.zonata* has been recorded than other species due to less humidity and minor fluctuation in temperature. But then from week 7 to week 14, the *B.zonata* abundance increase gradually along with *B.invadens* and *B.dorsalis complex* when the humidity rises and

temperature fluctuate at decreasing side. *B.cucurbitae* abundance decrease in methyl eugenol treatment (T1) group from week 9 to 14 due to methyl eugenole which not attract *B.cucurbitae*.

## Discussion

Genus *Bactrocera* have 651 identified species in which 50 is considered the most important pest for various fruits and vegetables that decrease the quantity and quality of different host in the world which is feeding on different kind of food. These species are distributed throughout in the Asia, Australia and South (White and Elson-harris, 1992). 270 host plants were recorded for *B. dorsalis* (hendel), oriental fruit fly, (Allwood,. 1999).

This was the first study conducted in seven different tehsil of district lower dir khyber pukhtunkhwa i.e. Adenzai, Balambat, Khall, Lal qilla, Munda, Samar bagh and Timergara in twenty different peach orchards. The aim and objectives of the study were, to study the taxonomy of genus *Bactrocera* attracted to methyl eugenole and cue lure as well as their abundance, relative humidity, temperature and efficacy of two pheromones. Peach is an economically important fruit because it is imported to other countries. These fruit flies damage the fruits and lower its yield quality and quantity which is a big loss to farmers. The studies were carried out in summer from June to August (2021) in different varieties of peach orchards and with the help of available literature and taxonomic keys of Drew and Romig (2013) and by comparison with already identified specimen. Total six fruit flies were reported in district lower Dir i.e, *Bactrocera invedense*, *Bactrocera zonata*, *Bactrocera dorsalis*, *Bactrocera cucurbitae*, *Bactrocera tau*, and *Bactrocera scutellaris* which were attracted by two pheromones i.e. methyl eugenol and cue lure in peach orchards. The characteristics of all the identified species were studied according to their body parts. Important body parts of genus *Bactrocera* like marks on wings, scutum, setae, medial postsulral yellow, scutellum and T-pattren were observed.

Zubair, et al (2019) reported nine species of family tephritidae, genus i.e. *Bactrocera* and *dacus* by using taxonomic keys of Mahmood and Hassan (2005), and pictorial key of Prabarker key (2012) in among them *Dacus sphaerodalis*, *Bactrocera scutellaris*, *B. nigrofemoralis*, *B. correcta*, *B. tau* and *B. correcta* were reported for the first time in division Azad jammu and Kashmir. While i reported six species of family tephritidae genus *Bactrocera* for the first time in

district lower Dir by using Drew and Romig (2013) key and all these species are present in Pakistan. The reported nine species of Zubair, et al (2019) which are already present in Azad jammu and Kashmir and Pakistan except *Dacus longicornis* which is reported for the first time in Pakistan. Fruit fly is the most serious pest in the world, if these species were not control they were damage the fruits and vegetables up to 24% (stonehouse et al., 1998).

Zubair, et al (2019) installed the mcphail traps by using the pheromones methyl eugenol and cue lure along with mixing of malathion (insecticide) in different fruits and vegetables orchards i.e. fig, peach, pear, guava, apple, parsimmon and cucumber (different host), 6-8 traps in one hectare and noticed number of species in each traps in one years.

A total 18374 number of *Bactrocera* species were recorded in methyl eugenole traps in 14 weeks, in which *Bactrocera zonata* were highly attracted (57.428%), *Bactrocera invadens* were (30.205%), *Bactrocera cucurbitae* were (0.517%), *Bactrocera dorsalis complex* were (11.842%), *Bactrocera tau* were (0.005%) and *Bactrocera scutellaris*. Among them *Bactrocera zonata* were reported maximum (57.428%) in number and *Bactrocera tau* were minimum (0.005%) in methyl eugenole traps. Total 1667 number of *Bactrocera* species were recorded in cue lure traps in 14 weeks, in which *Bactrocera zonata* were (33.653%), *Bactrocera invadens* were (12.297%), *Bactrocera cucurbitae* were (47.570%), *Bactrocera dorsalis complex* were (3.959%), *Bactrocera tau* were (2.039%) and *Bactrocera scutellaris* were (0.01%). Among them *Bactrocera cucurbitae* were reported maximum (47.570%) in number and *Bactrocera tau* were minimum (2.039%) in cue lure traps. *B. zonata* is the most abundant species in Pakistan which is mostly present in Punjab, Sindh, Baluchistan, Islamabad and Peshawar (Sarwar, 2006). Temperature played significant role in population of fruit flies. Temperature effect on species of *Bactrocera*. Tests were conducted in which the effect of temperature was tested on species under maximum temperature, minimum temperature, mean temperature and relative humidity. Temperature plays a key role in development, survival and reproduction of *Bactrocera* species and other insects (Liu, x., and Ye, h. 2009). The cotton swab was suspended inside the cylindrical traps with the help of steel wire. 5ml methyl eugenol and 3ml lannate were injected into three traps and 5ml cue lure and 3ml lannate were injected in to three traps with the help of syringe. The data were collected on weekly basis so the traps were renewed on weekly basis. Methyl eugenol and cue lure were used to attract the male fruit flies. The developmental time increased when the temperature was above 33°C (Liu, x., and Ye, h. 2009). Lannate is used as

insecticides to kill the fruit flies. The relative temperature and humidity were noted on every week. It was checked on weekly basis on high and low and mean temperature that how much fruit flies were produced in a certain temperature and what was the effect of temperature on methyl eugenol and cue lure that were used to attract the male fruit flies. Lannate was used as insecticides to kill the fruit flies. Methyl eugenol attracts male *B.dorsalis* while cue lure attracts male *B.cucurbitae* (Khan *et al.* 2007). There are two lure which attract different male *Bactrocera spp* i.e methyl eugenol and cue lure (Khattak *et al.* 2012). Highly populations were recorded in methyl eugenol while lower were recorded in cue lure.

There are different treatments applied on the species for a period of 14 weeks. During this time two treatments were used in six pheromones traps, three traps for one treatment (methyl eugenol) and three traps for another treatment (cue lure). Six cylindrical traps were installed with two treatments and three replications. Three cylindrical pheromones traps were set from the following materials. 5ml methyl eugenol and 3ml lannate were inject into cotton swab inside the traps. Three cylindrical pheromones traps were set from the following materials. 5ml cue lure and 3ml lannate were inject into cotton swab inside the traps.

Pakistan is located in south asia which has a huge agriculture land for fruits and vegetables, so their fruits fly's species comes from others neighbor countries (Norrbom *et al.*, 1999; Wang xj *et al.*, 2002; Drew, 2004).

Because of the extensive host range of its species and the invasive capability of some species within the genus, *Bactrocera* is considered a severe hazard to horticulture crops Sarwar (2013). The results obtained from (Hamed *et al.*, 2013) also indicate that *B. zonata* enormously created fruit flies which had a tremendous effect on mangoes. The mango was discovered to be the most favored host of the *B. zonata* fly, followed by the peach and the apple. Fruit fly *B. zonata* adults feed constantly on mango emerged at a rate of 84.53 percent, which was higher than other hosts. During the corresponding feeding times, the flies feed on peach exhibited 81.09 percent emergence, whereas the flies feed on apple showed 75.06 percent emergence Sarwar (2013). Oriental fruit fly, a highly invasive species *B. dorsalis* and *B. invadens*, is now part of a complex of fruit and vegetable pests in Sub-saharan africa (Mutamiswa, 2021). *B. dorsalis* is expected to establish and spread over the tropics and subtropics as a result of climate change, eventually moving into warm temperate zones (Huan *et al.*, 2019). Furthermore, the fly was more common in hot, humid low-altitude environments than in dry medium-altitude ones (Hassani *et al.*, 2016).

We have found that three species are the infesting pests of peach while the remaining three were not the infesting species, these three species may have some others host fruits in their surrounding environment. The integrated pest management (IPM) should need to control population and to know about the economic value of tephritidae family (Ronchi-teles and Silva, 2013).

### **Conclusion**

From the present study the taxonomic fauna of genus *Bactrocera* attracted to methyl eugenol and cue lure traps in peach orchard at district Dir lower, Khyber Pukhtunkhwa, Pakistan showed that the following six species was identified in ari swat, i.e. *Bactrocera invedense*, *bactrocera zonata*, *Bactrocera dorsalis*, *Bactrocera cucurbitae*, *Bactrocera tau* and *Bactrocera scutellaris*. The percentage of abundance was also calculated along with temperature and relative humidity with the help of hygrometer. The efficacy of methyl eugenol is more than cue lure. The most abundant species was *Bactrocera zonata* and as major attracted by methyl eugenol. The most abundant species of cue lure was *Bactrocera cucurbitae*. The current study also showed that the highest number of species was much more during high humidity.

### **Recommendation**

After the study i will recommend the following points. Aware the farmers about the harmful effects of genus *Bactrocera* Government should need to control these harmful pest Use biological controls methods instead of chemical control methods. IPM should need to check the exported and imported fruits of Pakistan. Farmers should need to grow good varieties of fruits.

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