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## Species diversity and identification of important fruit flies damaging Guava (*Psidium guajava* L.) in Ranga Reddy district, Telangana, India

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**Abstract**

Studies were conducted during the rainy season of the years 2018 and 2019 to identify the economically important fruit fly species that are damaging guava crop in Ranga Reddy district of Telangana State. In Telangana State, guava is grown in about 2608 ha. Different pest and diseases found to damage the guava fruit and tephritid fruit flies is an important and economically significant pest as it causes huge damages to guava fruits. The fruit fly surveillances were conducted using methyl eugenol para pheromone traps. The results revealed that a significant population of three species of fruit flies belongs to Genus *Bactrocera* namely; *Bactrocera dorsalis*, *B. correcta* and *B. zonata* were trapped during both years. A total of 698 and 971 numbers of *B. dorsalis* flies were trapped during the year 2018 and 2019 respectively. The commonly damaging guava fruit fly, *B. correcta* population was lesser than the other two species. During the year 2018, a mean number of 4.80 flies of *B. dorsalis* were trapped at 7 DATP (days after trap placement) and population gradually increased during subsequent weeks and reached a peak of 40.80 numbers at 49 DATP. A similar trend was noticed during the year 2019 in the population of *B. dorsalis*. However the peak population of 43.20 numbers were recorded at 42 DATP. Among the three species *B. dorsalis* was found to dominate the other two species during the years 2018 and 2019. The identification keys provided in this paper will be useful to identify the fruit fly species by extension functionaries.

**Keywords:** guava, fruit fly, surveillance, identification keys, species diversity

**1. Introduction**

Guava (*Psidium guajava* Linn.) is one of the important commercial fruits grown in different states of India. It is the fourth most important fruit after mango, banana and citrus fruits [15]. It is popularly called the poor man's fruit or apple of the tropics is a popular tree fruit and is native to tropical America growing from Mexico to Peru. It has been adapted well in India and appears to be an Indian fruit [21]. The fruit is popular due to its less cost and high profile nutrients and forms a cheap source of vitamins and minerals. The crop is grown in both tropical and subtropical regions up to 1500 meters above mean sea level. The area under guava production in the country is about 0.27 million hectares with the production of 4.05 million tonnes of fruit per annum with average productivity of 15.30 metric tonnes per hectare. Uttar Pradesh is the leading state in guava production followed by Madhya Pradesh, Bihar and Andhra Pradesh. The newly formed state, Telangana has a production of 0.38 million tonnes during the year 2017-18 [3] and 2608 ha area is under cultivation mainly in Ranga Reddy, Medak and Mahabubnagar districts of the state [1].

Fruit flies are tiny insects belongs to the order Diptera found damaging different types of soft bodied fruits and vegetables. They can cause damage to vegetable and fruits from 20 to 100 per cent. In India, fruit flies are found to cause damage in a wide variety of fruit crops, among which guava is an important crop which is being damaged by different fruit fly species. Fruit flies are considered a highly destructive pest of guava fruit production in India causing yield losses and quality degradation of the produce. It is recorded, that fruit losses caused by fruit fly ranging from 20 to 80 per cent usually depend upon the crop locality, season and variety [12]. The damage due to different fruit fly species is the major problem in the production of rainy season guava. Infestation by fruit flies is in the range of 20 to 46 per cent with losses of 16 to 40 per cent is observed in Uttar Pradesh [12].

About 30 per cent of average damage is observed in rainy season guava. In guava, 20 to 80 per cent crop loss has been found in India and Pakistan [8] and it ranged from 33.30 to 66.70 per cent in Ethiopia [4]. Although detailed studies on crop loss are lacking, the infestation of fruit fly in winter guava is relatively less due to low temperature and dry winter in most parts of India<sup>13</sup> whereas in Telangana state with tropical climatic condition, the fruit fly damage is present throughout the year irrespective of the seasons.

Adult fruit flies damage the guava fruit by laying their eggs in the ripening fruit or soft fruits causing blemishes and discoloration. The eggs hatch into maggots that bore into the fruit, develop inside and pave the way for secondary infections through fungi or bacteria, which is causing extensive rotting and dropping of fruit. Damaged fruits are unhealthy and unfit for human consumption. Among different fruit fly species damaging guava crop, *Bactrocera dorsalis*, *B. zonata*, *B. correcta*, *B. caryea* and *Zeugodacus tau* are important fruit flies that cause a higher level of damage in guava growing areas of India. Males of these fruit fly species are attracted to methyl eugenol lure [9, 10, 11, 16, 18] and can be trapped using this para-pheromone except *Z. tau* which is attracted to Cue lure [5, 20, 22].

Studies on species diversity and their identification keys for fruit flies that are damaging guava fruits in Ranga Reddy district were not done earlier. Hence studies were carried out in Ranga Reddy district of Telangana state, India during the rainy season of the year 2018 and 2019 to find out different fruit fly species that are damaging guava fruits. The trapped fruit flies were identified using available identification keys. The identification keys of these economically important fruit flies will help the farmers and extension functionaries to identify the fruit fly species and better management at the field level.

## 2. Materials and Methods

The present study was conducted at guava orchards of Reddipally village (17.3739° N, 78.2469° E) in Ranga Reddy district of Telangana state, India during the rainy season and fruit maturity months of the year 2018 and 2019. The fruit fly damages the fruits before harvest when the fruits are about to ripen. However, the immature fallen fruits and local varieties act as a source of breeding. Hence, fruit fly trapping was done during the rainy months of August and September and species identification was done after each collection of trapped fruit flies on weekly basis.

In the guava orchards five numbers of methyl eugenol traps per acre were placed at a uniform distance to cover the entire orchard. Two numbers of cue lures were also placed in the field to study the presence of *Z. tau*. The traps with lure were placed at 1.5 to 2 metre height in the guava trees. Observations were done on 7, 14, 21, 35, and 49 days after placement of traps (DAPT). 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 the Pest Detection Laboratory of National Institute of Plant Health Management, Hyderabad for identification. Identification was carried out using taxonomic keys and species descriptions [7] and also using the Australian Handbook for the identification of fruit flies<sup>2</sup>. Identification keys were picturised in computer assisted microscope to bring out important identification characters of trapped fruit flies. The data on trapped fruit flies were subjected to statistical analysis and results are presented in this paper.

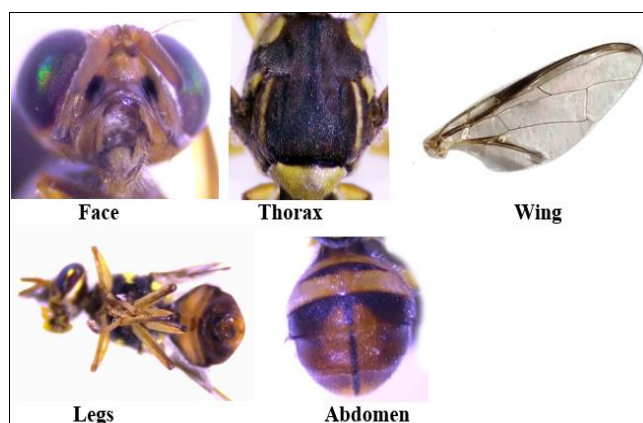
## 3. Results and Discussion

### 3.1. Identification of trapped fruit flies

The fruit flies trapped in the experimental field were collected on a weekly basis and brought to Pest Detection and Identification Laboratory of NIPHM. The species level identification using identification keys were carried out. The fruit flies identified were *B. dorsalis*, *B. zonata* and *B. correcta*. The illustrative pictures and identification keys are furnished at 3.1.1, 3.1.2 and 3.1.3.

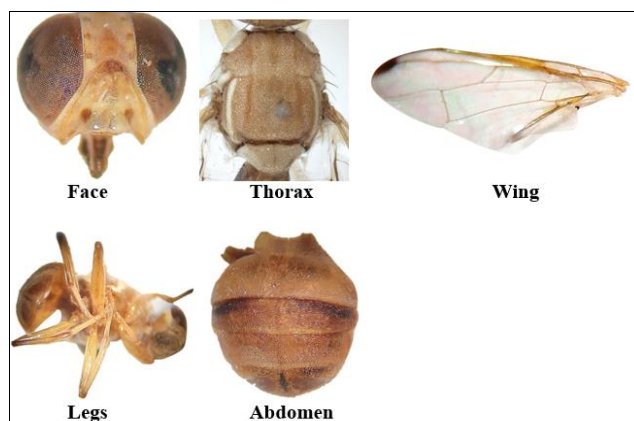
#### 3.1.1. *Bactrocera dorsalis* (Hendel)

Medium sized with predominantly black or dark fuscous, or a balanced mixture of black and yellow coloured fly. Face with transverse sulcus, or with distinct antennal grooves, carina with dark spots in antennal furrows, scutum is black with orange to red-brown or black with two pale whitish to yellow post sutural stripes extending to intra-alar bristles or beyond. Legs with all femora entirely yellow colour and fore tibia usually dark. Wings with the ratio of width of the apical band in cell  $R_{4+5}$  and narrow costal band dips in at end of  $R_{2+3}$  and with very narrow anal streak. Abdominal tergites with a medial dark stripe on  $T_3$ - $T_5$  and a transverse dark line on  $T_3$ .



#### 3.1.2. *Bactrocera zonata* (Saunders)

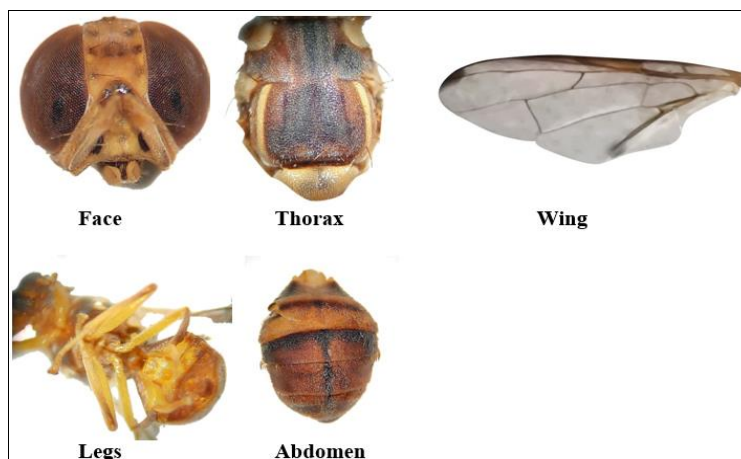
Medium sized fly and adult are pale orange brown to red coloured. Head with two pairs of frontal bristles, one pair of orbital bristles. The face is with small oval shaped black spot. Scutum red-brown with two lateral yellow vittae of medium size. Anterior supra alar setae, prescutellar setae, two scutellar setae are present. Scutellum yellow with the narrow dark red-brown basal band. Legs are fulvolus with apices of femora red-brown coloured. Wings with costal band with only cell Sc and apex of vein  $R_{4+5}$  coloured. Abdominal tergites with a medial dark stripe, usually on  $T_3$ - $T_5$  or with a medial dark stripe on  $T_5$  only.



### 3.1.3. *Bactrocera correcta* (Bezzi)

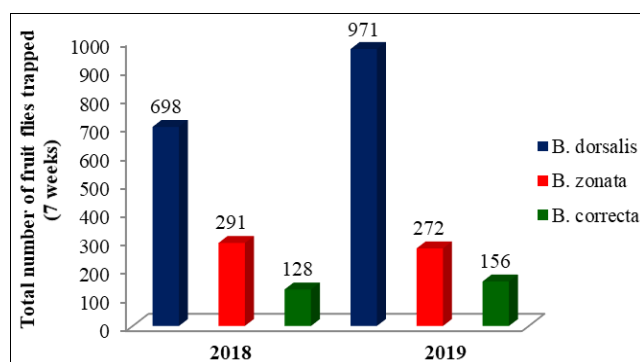
Small to medium sized fly with a balanced mixture of black and yellow colour body. Face with spots on transverse sulcus extended medially (linear), or with a transverse band (narrow). Scutum black or red-brown with black band or lanceolate with two pale whitish to yellow post sutural stripes (lateral). Legs with all segments entirely fulvous except hind tibiae pale fuscous. Wings with the costal band with only cell Sc and apex of vein R<sub>4+5</sub> coloured. Anal band present,

reaching nearly to wing margin along with cell cup extension (narrow). Vein M distally straight and a spot on end of the wing. Abdominal terga III-V is red-brown with a 'T' pattern consisting of a narrow transverse black band across the anterior margin of tergum III. A narrow medial longitudinal black band over all three terga, narrow black anterolateral corners on terga IV and V. A pair of oval red-brown shining spots on tergum V.



### 3.2. Total number of fruit flies trapped

The total number of fruit flies trapped in guava orchards during the year 2018 and 2019 are presented in Fig. 1. The results obtained revealed that during both years *B. dorsalis* dominated the other two recorded fruit fly species *B. zonata* and *B. correcta*.



**Fig 1:** Total number of fruit flies trapped in guava orchard during the year 2018 and 2019

During the year 2019, significantly higher numbers of fruit flies were trapped compared to those trapped in the year 2018. Among different species the dominant fruit fly, *B. dorsalis* recorded 971 numbers in the year 2019 whereas 698 numbers were trapped in the year 2018. Similarly 156 numbers of *B.*

*correcta* were trapped in the year 2019 whereas only 128 numbers were in the year 2018. In case of *B. zonata*, more flies (291) were trapped in the year 2018 as compared to flies trapped (272) in the year 2019. The findings of the present study are concurrent with the earlier report<sup>14</sup> that in South India these three fruit fly species were found to cause damages in mango and guava fruit crops. The earlier report of *B. correcta* is dominant species in guava crop in South India<sup>14</sup> and Eastern India<sup>6</sup> and sometimes its population is 80 per cent in comparison to the population of other two species *B. dorsalis* and *B. zonata* are in contrary to the present finding. However, the previous reports revealed that *B. correcta* is found in dominance in states like Tamil Nadu, Kerala, Karnataka, Maharashtra and Gujarat whereas there is no report that it is a dominant species in Telangana state. The dominance of different fruit fly species damaging guava fruit varies from state to state and area to area and it was reported that *B. zonata* was found dominating in Patna whereas *B. correcta* was found to dominate in the Ranchi area<sup>13</sup>. The result obtained in the present study is strengthened by the above earlier findings.

### 3.3. Species level fruit flies trapped

The number of fruit flies trapped 7, 14, 28, 42, and 49 days after placement of traps during the rainy season of the year 2018 and 2019 are presented in Tables 1 and 2 respectively.

**Table 1:** Species wise mean number of fruit flies trapped during the year 2018

| Species            | Mean number of fruit flies trapped |              |              |               |               |               |               |
|--------------------|------------------------------------|--------------|--------------|---------------|---------------|---------------|---------------|
|                    | 7 DATP                             | 14 DATP      | 21 DATP      | 28 DATP       | 35 DATP       | 42 DATP       | 49 DATP       |
| <i>B. dorsalis</i> | 12.55a(4.80)                       | 13.55a(5.60) | 16.76a(8.40) | 29.81a(24.80) | 28.48a(22.80) | 34.65a(32.40) | 39.67a(40.80) |
| <i>B. zonata</i>   | 6.39b(1.60)                        | 5.55b(1.20)  | 9.17b(2.60)  | 16.79b(8.40)  | 24.45b(17.20) | 22.21b(14.40) | 20.87b(12.80) |
| <i>B. correcta</i> | 3.44b(0.60)                        | 5.07b(1.00)  | 2.29c(0.40)  | 10.13c(3.20)  | 12.47c(4.80)  | 15.47c(7.20)  | 16.68c(8.40)  |
| SE                 | 1.26                               | 1.47         | 1.07         | 0.99          | 0.98          | 0.98          | 0.79          |
| CD                 | 4.18**                             | 4.85**       | 3.53**       | 3.30**        | 3.27**        | 3.25**        | 2.64**        |
| CV %               | 37.85                              | 40.67        | 25.33        | 11.77         | 10.11         | 9.11          | 6.94          |

B. – *Bactrocera*; DATP – Day after trap placement; SE – Standard Error; CD – Critical Difference; CV – Coefficient of variance; \*\*  $P < 0.01$ ; Figures in parentheses are original values while those outside are arc sine transformed values



The data recorded on different fruit fly species in guava fruit crop in the year 2018 revealed that *B. dorsalis* dominated in all eight weeks of trapping. In the first week (7 DATP), significantly higher number of *B. dorsalis* (4.80) was trapped and the remaining two species were on par with each other up to second week after the trap placement. Significant differences in the number flies trapped were observed from the third week (21 DATP) to seventh week (49 DATP) among all three species. Highest number of 40.80 flies of *B. dorsalis* was recorded during the fruit ripening stage i.e. 49 DATP whereas highest number of *B. zonata* (17.20) was observed at 35 DATP and about *B. correcta*, higher average of 8.40 flies were trapped at 49 DATP. The average fruit flies trapped were increased from 7 DATP and attained a maximum population at 49 DATP. There was an increase trend in the average flies trapped with respect to *B. dorsalis* and *B. correcta* from 7DATP to 49 DATP whereas the average number of trapped flies of *B. zonata* reached maximum (17.20) at 35 DATP and started declining to 12.80 at the ripening stage (49 DATP). In all seven weeks, the average

number of trapped flies of all three species significantly varied.

From the Table 2, it is revealed that during the year 2019 also *B. dorsalis* found dominating the other two species *B. zonata* and *B. correcta*. The average number of *B. dorsalis* trapped significantly higher in all the seven weeks of trapping and it was 8.20 in the first week (7 DATP) whereas the other two species *B. zonata* (3.20) and *B. correcta* (1.60) were on par with each other at 7 DATP. During the second week of trapping (14 DATP) the number of trapped flies significantly increased as compared to the first week of trapping. The mean number of 19.60, 7.00 and 1.00 of *B. dorsalis*, *B. zonata* and *B. correcta* were trapped respectively at 21 DATP. The maximum mean number of 43.20 of *B. dorsalis*, 11.00 of *B. zonata* and 9.00 of *B. correcta* were recorded at the sixth week (42 DATP) of trapping and the population of *B. zonata* and *B. correcta* was significantly on par during the fruit ripening stage i.e. 42 and 49 DATP. At 49 DATP, the mean number of 39.20 of *B. dorsalis*, 9.40 of *B. zonata* and 8.40 of *B. correcta* were recorded.

**Table 2:** Species wise mean number of fruit flies trapped during the year 2019

| Species            | Mean number of fruit flies trapped |               |               |               |               |               |               |
|--------------------|------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
|                    | 7 DATP                             | 14 DATP       | 21 DATP       | 28 DATP       | 35 DATP       | 42 DATP       | 49 DATP       |
| <i>B. dorsalis</i> | 16.57a(8.20)                       | 20.89a(12.80) | 26.21a(19.60) | 34.63a(32.40) | 38.48a(38.80) | 41.04a(43.20) | 38.74a(39.20) |
| <i>B. zonata</i>   | 9.96b(3.20)                        | 13.24b(5.40)  | 15.26b(7.00)  | 16.79b(8.40)  | 18.25b(10.00) | 19.23b(11.00) | 17.76b(9.40)  |
| <i>B. correcta</i> | 6.39b(1.60)                        | 8.22c(2.20)   | 7.17c(1.60)   | 10.23c(3.20)  | 13.09c(5.20)  | 17.40b(9.00)  | 16.69b(8.40)  |
| SE                 | 1.56                               | 0.75          | 0.90          | 0.87          | 1.27          | 1.13          | 0.79          |
| CD                 | 5.17**                             | 2.48**        | 2.99**        | 2.87**        | 4.19**        | 3.76**        | 2.62**        |
| CV %               | 31.77                              | 11.87         | 12.44         | 9.44          | 12.16         | 9.79          | 7.25          |

B. – *Bactrocera*; DATP – Day after trap placement; SE – Standard Error; CD – Critical Difference; CV – Coefficient of variance; \*\*  $P < 0.01$ ; Figures in parentheses are original values while those outside are arc sine transformed values

The findings are concurrent with the earlier reports that species level variation in guava fruit crop found in different areas [13]. The earlier findings that there is a higher incidence of *Bactrocera* spp. complex damage in guava crop during rainy months August and September in Karnataka state agree with present results [17]. Among different fruit fly species, *B. dorsalis* is the statistically the most important and destructive pest in the guava fruit crop reported earlier strengthen the present findings [23].

#### 4. Conclusion

From the study, it was found that among different species of fruit flies found damaging guava fruits, only *B. dorsalis*, *B. correcta* and *B. zonata* were present during the rainy season of the year 2018 and 2019 in Ranga Reddy district of Telangana state. The *B. dorsalis* found dominating the other two species *B. zonata* and *B. correcta*. Proper identification of fruit fly species using identification keys can help extension functionaries for chalk out a management plan and recommendation of appropriate para pheromone for trapping.

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