INFLUENCE OF WEATHER PARAMETERS ON FRUIT FLY TRAP CATCHES IN DHARWAD, KARNATAKA

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ABSTRACT: Studies were made on the fruit fly population dynamics and influence of weather parameters in guava and mango orchards at Dharwad (Karnataka, South India) from July 2004 to June 2005 by using methyl eugenol traps. Fruit fly population was observed throughout the year in both guava and mango orchards. In guava orchard, population of *Bactrocera correcta* peaked during first week of July in 2004 and fourth week of May in 2005. *B. dorsalis* had three peaks in 2004 during first week of July, second and fourth week of November while in 2005, the population peaked during second week of March and May. Population of *B. zonata* showed one major peak in 2004 during second week of November and two peaks in 2005 during third week of April and May. In mango orchard, *B. correcta* had one peak each in 2004 and 2005 during first week of July and second week of May, respectively. *B. dorsalis* had two peaks in 2004 during first week of July and third week of November while in 2005, it showed one peak during third week of May. In 2004, *B. zonata* had one peak during fourth week of September while in 2005, it had three peaks during third week of March, second week of April and fourth week of May. In guava, *B. correcta* and *B. zonata* had significant positive correlation with temperature, while *B. dorsalis* had significant negative correlation with morning relative humidity and rainfall. In mango, *B. correcta* had highly significant positive correlation with minimum temperature and relative humidity. *B. dorsalis* and *B. zonata* had highly significant positive correlation with temperature and negative correlation with afternoon relative humidity.

INTRODUCTION

Among the various tropical fruits, guava (*Psidium guajava* Linn.) the apple of tropics, is the fourth most important fruit crop in India, with an area of 1.60 lakh hectares, and production of 18.50 lakh tonnes while mango (*Mangifera indica* Linn.) the king of fruits, accounts for 38 per cent of the area and 23 per cent of the output of all fruits in the country. (Anonymous, 2004). Fruit flies are the important pests of these fruits causing heavy economic losses (Narayanan and Batra, 1960; Verghese *et al.*, 2002). Three species of fruit flies namely *Bactrocera correcta* Bezzi, *B. dorsalis* (Hendel) and *B. zonata* Saunders occur in guava and mango fruits in northern Karnataka (Suresh Babu and Viraktamath, 2003; Rajitha and Viraktamath, 2005). In an order to develop effective management practices, a through knowledge of population dynamics of the fruit flies in guava and mango orchards is essential so that locality specific forecasting models can be developed. Hence, studies were made on fruit fly population dynamics in guava and mango orchards at Dharwad (Karnataka, South India) and the results are presented in this paper.
MATERIAL AND METHODS

Studies on population dynamics and influence of weather parameters were made for one calendar year from July, 2004 to June, 2005. Traps were prepared by using transparent bottles (500 ml). Each trap had four holes of 20 mm diameter in different directions at the middle region of the bottle for entry of fruit flies. An iron wire was inserted inside the bottle up to the level of holes, by piercing through the lid of the bottle and the tip of the wire was twisted to make a loop. The other end of the wire protruding out of the bottle was used for hanging the trap to the trees. A cotton wad charged with 0.4 ml of methyl eugenol and 1 ml of dichlorvos was placed in the loop of the wire. Six traps spaced at 50 m were set up separately in guava and mango orchards, of the University of Agricultural Sciences, Dharwad, Karnataka, India which is located at 15° 26' North latitude, 75° 07' East longitude at an altitude of 678 m above mean sea level. These traps were charged with 0.4 ml of methyl eugenol and 1 ml of dichlorvos at monthly and fortnightly intervals respectively. The fruit flies were collected and identified to species level at weekly intervals.

Meteorological parameters like maximum temperature, minimum temperature, morning and afternoon relative humidity and rainfall data were collected from Agromet Advisory Unit of the University of Agricultural Sciences, Dharwad. Correlations were made between weekly trap catches and mean weather parameters like maximum temperature, minimum temperature, morning and afternoon relative humidity and rainfall for every standard week.

RESULTS AND DISCUSSION

a. Population dynamics of fruit flies in guava orchard

_B. correcta_ had the first major peak during 1st week of July (27th standard week) (211.17 fruit flies/trap/week) and two minor peaks during 1st week of October (41st standard week) and 2nd week of November (46th standard week) in 2004. In 2005, major peaks were observed during last week of May (22nd standard week) (83.00 fruit flies/trap/week) and 2nd week of June (24th standard week) (60.33 fruit flies/trap/week) (Fig. 1).

_B. dorsalis_ had three peaks during 1st week of July (27th standard week) (62.33 fruit flies/trap/week), 1st week of November (45th standard week) (111.00 fruit flies/trap/week) and last week of November (48th standard week) (114.17 fruit flies/trap/week) in 2004 and two peaks in 2005 during 1st week of April and May (14th and 19th standard weeks) (42.33 and 39.67 fruit flies/trap/week, respectively) (Fig. 1).

Though population of _B. zonata_ was recorded throughout the year, the catches were relatively low ranging from 0.33 to 6.17 fruit flies. Major peak catches were recorded during 1st week of November (45th standard week) of 2004 (42.33 fruit flies/trap/week) and 11th and 20th standard weeks of 2005 (6.17 and 5.00 fruit flies/trap/week respectively) (Fig. 1).

When the total number of fruit flies were considered, irrespective of the species, three peaks were observed during 27th (274.33 fruit flies/trap/week), 45th (128.66 fruit flies/trap/week), 48th standard week (121.17 fruit flies/trap/week) in 2004 and 21st (106.99 fruit flies/trap/week) and 22nd standard week (114.66 fruit flies/trap/week) in 2005 (Fig. 1).

b. Population dynamics of fruit flies in mango orchard

_B. correcta_ had the first major peak with highest captures of 230.33 fruit flies/trap/week during 1st week of July (27th standard week) and two minor peaks during 32nd and 47th standard weeks in 2004 (Fig. 2). In 2005, a major peak was observed (66.50 fruit flies/trap/week) during 1st week of June (23rd standard week).

Two major peaks of _B. dorsalis_ were recorded during 1st week of July (27th standard
Fig. 1: Fruit fly population dynamics in guava orchards during 2004-05 at Dharwad
Fig. 2: Fruit fly population dynamics in mango orchards during 2004-05 at Dharwad
week) (269.67 fruit flies/trap/week) and 3rd week of November of 2004 (47th standard week) (132.67 fruit flies/trap/week). In 2005, higher populations were observed from 3rd week of May to 2nd week of June (89.61 to 224.50 fruit flies/trap/week) with a major peak of 224.50 fruit flies/trap/week during 2nd week of May (20th standard week) (Fig. 2).

The population of *B. zonata* peaked during 3rd week of September (39th standard week) (6.50 fruit flies/trap/week) in 2004. An increasing trend in fruit fly catches was observed from 3rd week of May to 3rd week of June coinciding with maturing of fruits, with a major peak of 37.67 fruit flies/trap/week during last week of May (21st standard week) (Fig. 2).

When total fruit flies were considered irrespective of the species, two major peaks were observed during 27th (500.33) and 47th standard week (164.50 fruit flies/trap/week) in 2004. In 2005, higher populations were observed from 3rd week of May to 2nd week of June, with two major peaks during 20th (314.34 fruit flies/trap/week) and 23rd standard week (292.83 fruit flies/trap/week) (Fig. 2).

Present results on the population dynamics of *B. correcta* on guava endorse the findings of Jalaluddin *et al.* (2001) who reported peak activity during July-August, which coincided with ripening of guava fruits. Similar results are also reported by Suresh Babu and Viraktamath (2003), Viraktamath and Suresh Babu (2004) and Rajitha and Viraktamath (2006a,b) on guava and mango at Dharwad.


Population dynamics of *B. zonata* on guava in the present studies was similar to the reports of Rajitha and Viraktamath (2006a) who recorded lower catches with peak captures on 45th, 11th and 12th standard weeks at Dharwad. However, Gupta and Bhatia (2000) and Chaudhary and Jamal (2000) reported peak catches during 37th and 39th standard weeks. Such low population of *B. zonata* obviously indicates that guava is not a preferred host at Dharwad. On mango, the variation in the population followed the same trend as reported by Agarwal and Kumar (1999), Agarwal *et al.* (1999), Gupta and Bhatia (2000) and Suresh Babu and Viraktamath (2003) and Rajitha and Viraktamath (2006b). However, Anjum *et al.* (2000) reported peak population during 1st week of July. Capturing of fruit flies in mango orchards during off-season in the present study was perhaps due to the presence of guava orchard nearby. Methyl eugenol can attract the fruit flies from a distance of 0.8 km (Roomi *et al.*, 1993).

c. Influence of weather parameters on fruit fly catches in guava

In guava orchard trap catches of *B. correcta* had a significant positive correlation with minimum temperature (*r* = 0.424**), morning relative humidity (*r* = 0.352*) and afternoon relative humidity (*r* = 0.326*). Weather factors together influenced the trap catches to an extent of 41.1 per cent (Tables 1 and 2). These findings are in accordance with Jalaluddin *et al.* (2001) who observed the population of *B. correcta* having a significant positive correlation with temperature and relative humidity. Viraktamath and Suresh Babu (2004) also observed similar relationship. However, Rajitha and Viraktamath (2006a) did not find any relationship with weather parameters.

Trap catches of *B. zonata* had high significant positive correlation with maximum temperature ($r=0.527^{**}$) and highly significant negative correlation with morning relative humidity ($r=-0.379^{**}$) and afternoon relative humidity ($r=-0.438^{**}$). All the weather factors together influenced the trap catches to an extent of 40.5 per cent (Tables 1 and 2). Similar relationship was observed by Agarwal and Kumar (1999) and Viraktamath and Suresh Babu (2004) and Rajitha and Viraktamath (2006a).

**Table 1. Correlation coefficient(s) of trap catches with weather parameters in guava orchard**

<table>
<thead>
<tr>
<th>Fruit fly species</th>
<th>Temperature (°C)</th>
<th>Relative humidity (%)</th>
<th>Rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
<td>Morning</td>
</tr>
<tr>
<td><em>B. correcta</em></td>
<td>0.017</td>
<td>0.424**</td>
<td>0.352*</td>
</tr>
<tr>
<td><em>B. dorsalis</em></td>
<td>0.075</td>
<td>-0.140</td>
<td>-0.288*</td>
</tr>
<tr>
<td><em>B. zonata</em></td>
<td>0.527**</td>
<td>-0.034</td>
<td>-0.379**</td>
</tr>
</tbody>
</table>

n=52
* Significant at 5%
** Significant at 1%

**Table 2. Multiple linear regression coefficients of trap catches with weather parameters in guava orchard**

<table>
<thead>
<tr>
<th>Fruit fly species</th>
<th>Intercept</th>
<th>Temperature (°C)</th>
<th>Relative humidity (%)</th>
<th>Rainfall (mm)</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
<td>Morning</td>
<td>Afternoon</td>
</tr>
<tr>
<td><em>B. correcta</em></td>
<td>-307.789</td>
<td>9.3225*</td>
<td>-1.445 NS</td>
<td>-3.127 NS</td>
<td>1.584**</td>
</tr>
<tr>
<td><em>B. dorsalis</em></td>
<td>74.50</td>
<td>3.794 NS</td>
<td>2.506 NS</td>
<td>-7.625*</td>
<td>5.459 NS</td>
</tr>
<tr>
<td><em>B. zonata</em></td>
<td>-10.76</td>
<td>1.25**</td>
<td>-3.87 NS</td>
<td>-5.58*</td>
<td>1.09*</td>
</tr>
</tbody>
</table>

NS – Non-significant
* Significant at 5% level
** Significant at 1% level
Table 3. Correlation coefficient(s) of trap catches with weather parameters in mango orchard

<table>
<thead>
<tr>
<th>Fruit fly species</th>
<th>Temperature (°C)</th>
<th>Relative humidity (%)</th>
<th>Rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
<td>Morning</td>
</tr>
<tr>
<td>B. correcta</td>
<td>-0.080</td>
<td>0.354**</td>
<td>0.341*</td>
</tr>
<tr>
<td>B. dorsalis</td>
<td>0.322*</td>
<td>0.325*</td>
<td>0.094</td>
</tr>
<tr>
<td>B. zonata</td>
<td>0.730**</td>
<td>0.399**</td>
<td>0.006</td>
</tr>
</tbody>
</table>

n=52
* Significant at 5%
** Significant at 1%

Table 4. Multiple linear regression coefficients of trap catches with weather parameters in mango orchard

<table>
<thead>
<tr>
<th>Fruit fly species</th>
<th>Intercept</th>
<th>Temperature (°C)</th>
<th>Relative humidity (%)</th>
<th>Rainfall (mm)</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
<td>Morning</td>
<td>Afternoon</td>
</tr>
<tr>
<td>B. correcta</td>
<td>-260.39</td>
<td>8.29NS</td>
<td>-1.81NS</td>
<td>-3.19NS</td>
<td>1.58NS</td>
</tr>
<tr>
<td>B. dorsalis</td>
<td>-486.43</td>
<td>1.00*</td>
<td>-1.087NS</td>
<td>-3.36NS</td>
<td>1.225*</td>
</tr>
<tr>
<td>B. zonata</td>
<td>-28.97</td>
<td>1.03NS</td>
<td>5.55*</td>
<td>3.54NS</td>
<td>-9.91*</td>
</tr>
</tbody>
</table>

NS – Non-significant
* Significant at 5% level
** Significant at 1% level

d. Influence of weather parameters on fruit fly catches in mango

B. correcta had highly significant positive correlation with minimum temperature (r=0.354**), morning relative humidity (r=0.341*) and afternoon relative humidity (r=0.365**). All the weather factors together had influence on the trap catches to an extent of 38.8 per cent (Tables 3 and 4). Agarwal and Kumar (1999), Suresh Babu and Viraktamath (2003) and Rajitha and Viraktamath (2006b) endorsed these findings. Verghese and Sudhadevi (1998) and Gupta and Bhatia (2000) observed a positive correlation of B. dorsalis population with maximum and minimum temperature. There was a significant positive correlation between trap catches of B. dorsalis with maximum temperature (r=0.322*) and minimum temperature (r=0.325*). The weather factors together influenced the trap catches to an extent of 30.7 per cent (Tables 3 and 4). The captures of B. zonata had a highly significant positive correlation with maximum temperature (r=0.365**).
temperature \( (r=0.730^{**}) \) and minimum temperature \( (r=0.399^{**}) \). However all the weather parameters together influenced the trap catches to the tune of 65.2 per cent (Tables 3 and 4). Present results though are in agreement with the reports of Sushilkumar et al. (1997) with respect to temperature, but do not agree with respect to relative humidity. Similarly, Suresh Babu and Viraktamath (2003) found a positive correlation with minimum temperature but Rajitha and Viraktamath (2006b) reported a negative relation with temperature.

Varying results of the influence of weather parameters on trap catches of fruit flies have been reported both in guava and mango orchards. Chaudhary and Jamal (2000), Jalaluddin et al. (2001) and Sushilkumar et al. (1997) reported that the population of fruit flies coincided with ripening period of guava and mango fruits. Similarly, Shekharappa et al. (1998), Madhura (2001) and Suresh Babu and Viraktamath (2003) opined that availability of fruit crops influence the population fluctuation of fruit flies. Present results also endorse these views.

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