

Attraction of Female Fruit Flies to Different Protein Food Baits in Guava and Mango Orchards

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Abstract : Studies were made on attraction of female fruit flies to different protein food baits in farmers' commercial guava and mango orchards during 2005-06 near Dharwad. Food bait containing proteinex and 5 per cent ammonium acetate attracted significantly more *Bactrocera correcta* (5.17 fruit flies/trap/week), *B. dorsalis* (9.42 fruit flies/trap/week), *B. cucurbitae* (2.25 fruit flies/trap/week) and total fruit flies (16.84 fruit flies/trap/week) in guava. While in mango, fruit fly diet and mango pulp combined with 5 per cent ammonium acetate were attractive to *B. dorsalis* (7.63 and 4.63 fruit flies/trap/week, respectively), *B. cucurbitae* (3.00 and 4.25 fruit flies/trap/week, respectively) and total fruit flies (10.63 and 8.88 total fruit flies/trap/week, respectively). Food baits containing guava pulp with ammonium acetate in guava (5.59 total fruit flies/trap/week) and casein with ammonium acetate, mango pulp and proteinex with 5 per cent acetic acid (3.18, 4.63 and 3.51 total fruit flies/trap/week, respectively) were the next best treatments in mango.

Key words: Protein baits, female fruit flies, *Bactrocera correcta*, *B. dorsalis*, *B. cucurbitae*, guava, mango

Introduction

Mango and guava are two important fruit crops which are severely damaged by fruit flies. Most common species attacking these two fruits are *Bactrocera dorsalis* Hendel, *B. correcta* Bezzi and *B. zonata* (Saunders) (Verghese and Sudhadevi, 1998 and Rajitha and Viraktamath, 2005a). Female fruit flies are the dominant factor for multiplication of the pest. Female fruit fly attractive baits are needed in any applicative system against this pest for monitoring and direct control (Mazor *et al.*, 2002). They need protein source to mature sexually and also for the development of their eggs (Christenson and Foote, 1960). Exploiting this need, female targeted system normally consists of traps baited with a liquid solution made from protein and fermenting sugar (Epsky *et al.*, 1999, Mazor *et al.*, 2002). Increasing knowledge on behaviour associated with attraction of both sexually immature females and egg laying females would improve detection and delimitation of fruit flies and provide increased protection of crops adversely affected by their presence. Hence, the present studies were made on attracting female fruit flies to different protein food baits in guava and mango orchards and the results are presented in this paper.

Material and Methods

These studies were made during peak fruiting season of guava (1st week of October to 4th week of November, 2005) and mango (six weeks during April-May, 2006) in two separate commercial orchards at Mummigatti near Dharwad. Dharwad is located at 15° 26' North latitude, 75° 07' East longitude at an altitude of 678 m above mean sea level.

Different proteins tested were soybean yeast, casein, fruit fly diet, fish meal and proteinex. The first four proteins were

obtained from Hi Media Laboratories Private Limited, Mumbai, India and the last two were obtained from the local market. Protein food baits were prepared by using guava and mango pulp as base in guava and mango orchards, respectively. The experiment was laid out in a randomized block design with 14 treatments and two replications in mango and guava separately.

The details of treatments common to both guava and mango were as follows.

- T₁ – Soybean + sugar + pulp (1:1:1) + 5% ammonium acetate
- T₂ – Yeast + sugar + pulp (1:1:1) + 5% ammonium acetate
- T₃ – Casein + sugar + pulp (1:1:1) + 5% ammonium acetate
- T₄ – Fruit fly diet + sugar + pulp (1:1:1) + 5% ammonium acetate
- T₅ – Fish meal + 5% ammonium acetate
- T₆ – Guava pulp + sugar (1:1) + 5% ammonium acetate
- T₇ – Proteinex + 5% ammonium acetate
- T₈ – Soybean + sugar + pulp (1:1:1) + 5% acetic acid
- T₉ – Yeast + sugar + pulp (1:1:1) + 5% acetic acid
- T₁₀ – Casein + sugar + pulp (1:1:1) + 5% acetic acid
- T₁₁ – Fruit fly diet + sugar + pulp (1:1:1) + 5% acetic acid
- T₁₂ – Fish meal + 5% acetic acid
- T₁₃ – Pulp + sugar (1:1) + 5% acetic acid
- T₁₄ – Proteinex + 5% acetic acid

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The food baits were placed in small plastic cups separately and were kept inside the fruit fly traps. These traps were prepared from plastic cylinders (500 ml) with four holes of 20 mm in the middle part of the cylinder made in four different directions. The traps were hung with the help of iron wire to the guava and mango trees at the canopy level. The bait was always kept in semi liquid state by adding 10-15 ml water at regular intervals. Weekly observations on the number of fruit flies trapped in each trap were recorded, sexed and counted. Efficacy of each combination of food lure was evaluated by RBD analysis after $\sqrt{x+0.5}$ transformation of data.

Results and Discussion

Attraction of *B. correcta* : In guava orchard, trap baited with Proteinex + ammonium acetate (T_7) was the most superior food bait with mean catch of 5.17 fruit flies/traps/week (Table 1). Fruit fly diet + ammonium acetate (T_4) was the next best bait (1.59 fruit flies/trap/week). Food baits containing soybean, yeast, casein, fruit fly diet, fish meal and guava pulp along with acetic acid (T_8 , T_9 , T_{10} , T_{11} , T_{12} and T_{13}) were least effective. Surprisingly *B. correcta* attracted in mango orchard was negligible.

Attraction of *B. dorsalis* : In guava orchard, protein food baits containing Proteinex + ammonium acetate (T_7) attracted significantly more number of female fruits flies (9.42 fruit flies/trap/week) followed by the trap baited with guava pulp + ammonium acetate (T_6) with catches of 4.42 fruit flies/trap/week

(Table 1). Traps baited with casein and fruit fly diet along with acetic acid were least attractive (T_{10} , T_{11}) (0.17 fruit flies/trap/week).

In mango orchard, Fruit fly diet and mango pulp with ammonium acetate (T_4 and T_6) attracted significantly more female fruit flies (7.63 and 4.63 fruit flies/trap/week) (Table 2). The combination of casein + ammonium acetate (T_3) was the next best treatment, (2.93 fruit flies/trap/week) which was at par with the mango pulp + acetic acid (T_{13}) (2.25 fruit flies/trap/week). Yeast + ammonium acetate (T_2) was least attractive (1.00 fruit flies/trap/week). The remaining treatments did not attract any fruit fly. **Attraction of *B. cucurbitae* :** In guava, Proteinex + ammonium acetate (T_7) attracted significantly more number of female fruit flies (2.25 fruit flies/trap/week) followed by the traps baited with casein (1.75 fruit flies/trap/week), yeast (1.50 fruit flies/trap/week) along with ammonium acetate (T_2 and T_3) (Table 1). The lowest number of trap catches was recorded in the traps containing soybean, casein, fruit fly diet with acetic acid (T_8 , T_{10} and T_{11}). However, in mango orchard, mango pulp and Fruit fly diet with ammonium acetate (T_6 and T_4) attracted significantly more female fruit flies (4.25 and 3.00 fruit flies/trap/week) (Table 2). The next best treatments were mango pulp and Proteinex along with acetic acid (T_{13} , T_{14}) which were at par with each other. Fruit flies were not attracted to the bait containing soybean, yeast, casein, fruit fly diet, fish meal with combination

Table 1. Attraction of female fruit flies to different protein food baits in guava orchard

Treatments Species	Mean fruit flies/trap/week			
	<i>B. correcta</i>	<i>B. dorsalis</i>	<i>B. cucurbitae</i>	Total fruit flies
T_1 – Soybean + sugar + guava pulp (1:1:1) + 5% ammonium acetate	0.42 ^c (0.96)	1.84 ^d (1.53)	1.09 ^c (1.26)	3.35 ^d (1.96)
T_2 – Yeast + sugar + guava pulp (1:1:1) + 5% ammonium acetate	0.84 ^d (1.15)	2.08 ^d (1.60)	1.50 ^b (1.41)	4.42 ^d (2.21)
T_3 – Casein + sugar + guava pulp (1:1:1) + 5% ammonium acetate	0.83 ^d (1.15)	1.92 ^d (1.55)	1.75 ^b (1.50)	4.50 ^{cd} (2.23)
T_4 – Fruit fly diet + sugar + guava pulp (1:1:1) + 5% ammonium acetate	1.59 ^b (1.44)	2.00 ^d (1.58)	0.25 ^{ef} (0.87)	3.84 ^{dc} (2.08)
T_5 – Fish meal + 5% ammonium acetate	1.00 ^{cd} (1.22)	1.58 ^d (1.44)	0.59 ^d (1.04)	3.17 ^c (1.91)
T_6 – Guava pulp + sugar (1:1) + 5% ammonium acetate	0.75 ^d (1.11)	4.42 ^b (2.21)	0.42 ^{de} (0.96)	5.59 ^b (2.46)
T_7 – Proteinex + 5% ammonium acetate	5.17 ^a (2.38)	9.42 ^a (3.15)	2.25 ^a (1.66)	16.84 ^a (4.16)
T_8 – Soybean + sugar + guava pulp (1:1:1) + 5% acetic acid	0.17 ^e (0.82)	0.25 ^{ef} (0.87)	0.17 ^f (0.82)	0.59 ^{gh} (1.04)
T_9 – Yeast + sugar + guava pulp (1:1:1) + 5% acetic acid	0.17 ^e (0.82)	0.59 ^e (1.04)	0.33 ^{ef} (0.91)	1.09 ^f (1.26)
T_{10} – Casein + sugar + guava pulp (1:1:1) + 5% acetic acid	0.17 ^e (0.82)	0.17 ^f (0.82)	0.17 ^f (0.82)	0.51 ^h (1.00)
T_{11} – Fruit fly diet + sugar + guava pulp (1:1:1) + 5% acetic acid	0.17 ^e (0.82)	0.17 ^f (0.82)	0.17 ^f (0.82)	0.51 ^h (1.00)
T_{12} – Fish meal + 5% acetic acid	0.25 ^e (0.87)	0.59 ^e (1.04)	0.25 ^{ef} (0.87)	1.09 ^f (1.26)
T_{13} – Guava pulp + sugar (1:1) + 5% acetic acid	0.33 ^c (0.91)	0.42 ^{ef} (0.96)	0.17 ^f (0.82)	0.92 ^{fg} (1.19)
T_{14} – Proteinex + 5% acetic acid	1.25 ^{bc} (1.32)	3.50 ^c (2.00)	0.59 ^d (1.04)	5.34 ^{bc} (2.41)
S.Em±	0.044	0.063	0.038	0.059
CD at 5%	0.136	0.193	0.118	0.180

Means followed by the same letters do not differ significantly at $p=0.05$ by DMRT

Figures in parentheses indicate transformed value ($\sqrt{x+0.5}$)

Table 2. Attraction of female fruit flies to different protein food baits in mango orchard

Treatments	Mean fruit flies/trap/week		
Species	<i>B. dorsalis</i>	<i>B. cucurbitae</i>	Total fruit flies
T ₁ – Soybean + sugar + mango pulp (1:1:1) + 5% ammonium acetate	0.00 ^d (0.707)	0.00 ^e (0.707)	0.00 ^d (0.70)
T ₂ – Yeast + sugar + mango pulp (1:1:1) + 5% ammonium acetate	1.00 ^{cd} (1.207)	0.63 ^{cde} (1.015)	1.63 ^{cd} (1.45)
T ₃ – Casein + sugar + mango pulp (1:1:1) + 5% ammonium acetate	2.93 ^{bc} (1.827)	0.25 ^{de} (0.854)	3.18 ^{bc} (1.91)
T ₄ – Fruit fly diet + sugar + mango pulp (1:1:1) + 5% ammonium acetate	7.63 ^a (2.831)	3.00 ^{ab} (1.825)	10.63 ^a (3.33)
T ₅ – Fish meal + 5% ammonium acetate	0.00 ^d (0.707)	0.00 ^e (0.707)	0.00 ^d (0.70)
T ₆ – Mango pulp + sugar (1:1) + 5% ammonium acetate	4.63 ^{ab} (2.234)	4.25 ^a (2.141)	8.88 ^a (3.06)
T ₇ – Proteinex + 5% ammonium acetate	1.88 ^c (1.514)	1.63 ^{bcd} (1.452)	3.51 ^{bc} (2.00)
T ₈ – Soybean + sugar + mango pulp (1:1:1) + 5% acetic acid	0.00 ^d (0.707)	0.00 ^e (0.707)	0.00 ^d (0.70)
T ₉ – Yeast + sugar + mango pulp (1:1:1) + 5% acetic acid	0.00 ^d (0.707)	0.00 ^e (0.707)	0.00 ^d (0.70)
T ₁₀ – Casein + sugar + mango pulp (1:1:1) + 5% acetic acid	0.00 ^d (0.707)	0.00 ^e (0.707)	0.00 ^d (0.70)
T ₁₁ – Fruit fly diet + sugar + mango pulp (1:1:1) + 5% acetic acid	0.00 ^d (0.707)	0.00 ^e (0.707)	0.00 ^d (0.70)
T ₁₂ – Fish meal + 5% acetic acid	0.00 ^d (0.707)	0.00 ^e (0.707)	0.00 ^d (0.70)
T ₁₃ – Mango pulp + sugar (1:1) + 5% acetic acid	2.25 ^{bc} (1.612)	2.38 ^{bc} (1.685)	4.63 ^b (2.26)
T ₁₄ – Proteinex + 5% acetic acid	1.63 ^c (1.442)	1.88 ^{bc} (1.53)	3.51 ^{bc} (2.00)
S.E.m±	0.203	0.217	0.210
CD at 5%	0.622	0.665	0.644

Means followed by the same letters do not differ significantly at p=0.05 by DMRT

Figures in parentheses indicate transformed value ($\sqrt{x+0.5}$)

of acetic acid and soybean, fish meal with combination of ammonium acetate. Guava and mango are not the preferred natural hosts for *B. cucurbitae* (White and Elson Harris, 1992). It is likely that females trapped in the present study may be from other hosts nearby these guava and mango orchards. Attraction of total female fruit flies : In guava when total fruit flies were considered irrespective of individual species, proteinex + ammonium acetate (T₇) captured significantly highest number of 16.84 fruit flies/trap/week followed by guava pulp + ammonium acetate (T₆) (5.59 fruit flies/trap/week) which was on par with Proteinex + acetic acid (T₁₄) (5.34 fruit flies/trap/week) (Table 1). However, in mango, Fruit fly diet (T₄) and mango pulp (T₆) combined with ammonium acetate attracted significantly more number of female fruit flies (10.63 and 8.88 fruit flies/trap/week, respectively) followed by mango pulp + acetic acid (T₁₃) (4.63 fruit flies/trap/week) which was at par with casein + ammonium

acetate (T₃) and Proteinex + acetic acid (T₁₄) 3.18 and 3.51 fruit flies/trap/week, respectively (Table 2). Protein source as an important component in the food baits and commercial lures has been documented with *B. cucurbitae* (Steiner, 1952, Narayanan and Batra, 1960, Vijayasegaran, 1985; Satpathy and Samarjith Rai, 2002, Fabre *et al.*, 2003) and *B. dorsalis* (Steiner, 1952; Narayanan and Batra, 1960; Alyokhin *et al.*, 2000 and Cornelius *et al.*, 2000). Present results endorse these reports. Rajitha and Viraktamath (2005b) also reported attraction of female fruit flies to protein food baits in guava and mango orchards. Ammonium acetate is reported as most effective in attracting the fruit flies by Reissig (1976). Oatman (1964) used house hold ammonia effectively in controlling the fruit flies. It is concluded that Proteinex and guava pulp in guava and Fruit fly diet and mango pulp with 5 per cent ammonium acetate can be used in the management of fruit flies.

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