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Population Dynamics of Fruit flies in *Garcinia* spp. in Uttara Kannada district of Karnataka

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ABSTRACT: The population dynamics of fruit flies *Bactrocera dorsalis* Hendel, *B. correcta* Bezzi, *Bactrocera zonata* Saunders, and *Bactrocera versicolour* Bezzi were studied in the *Garcinia* spp. at Sirsi and Katagal locations in Uttara Kannada district of Karnataka in the Standard Metrological Week (SMW) 1 to 27 during 2021 and 2022. The fluctuations in the occurrence of adult fruit flies were assessed by using locally made methyl eugenol (ME) traps and the trap catches were recorded at fortnight intervals in fixed locations. The results revealed that *B. dorsalis* reached the peak (200.00 flies/trap and 210.25 flies/trap) in SMW 15th with an abundance of 55.51 and 53.25 percent during 2021 and 2022 in the Sirsi location. Similarly, in the Katagal location, the *B. dorsalis* reached the peak (210.12 flies/trap and 215.25 flies/trap) in SMW 15th with an abundance of 63.52 and 67.72 percent during 2021 and 2022. Relatively, the popuation of *B. correcta* were maximum (145.00 flies/trap and 165.00 flies/trap) was observed in SMW 15th with an abundance of 34.32 and 35.72 percent during 2021 and 2022 in the Sirsi location. In the Katagal location, the peak of the *B. correcta* (135.25 flies/trap and 139.25 flies/trap) was observed in SMW 15th with an abundance of 36.31 and 37.60 percent during 2021 and 2022 in *Garcinia indica* and the peak population of fruit flies coincided with peak fruiting. Comparable trap caches trend was observed in *G. morella* and *G. gummigutta*. Similarly, the *B. zonata* and *B. versicolour* trap caches and abundance were very low in both locations in *Garcinia* spp.

Keywords: *Bactrocera dorsalis*, *B.correcta*, *B. zonata*, *B. versicolour*, *Garcinia* spp, trap caches.

INTRODUCTION

Kokum is an under-exploited tree species found in tropical humid evergreen rain forests of the Western Ghats of India. In India among the known species reported, *G. indica* is the most valuable and known as wild mangosteen, Goa butter tree, *bhirand*, *anslil*, *amsol* (Konkani and Marathi), brindon (Portuguese Goa), *murugalu* (Kannada), *punarpuli* (Malayalam) (Nayak *et al*., 2010). *G. indica* has incredible potential as a spicy colorant with high medicinal value. This crop is considered a neglected and underutilized crop but essential to the livelihood of millions of poor farmers throughout the world. The total area in Karnataka is about 1200 ha with an annual yield of 8000 to 10000 tons of dried rind (Ramachandran *et al.*, 2014; Hegde, 2019). Very few insect pests attack *Garcinia* spp. and cause considerable damage. Among them, oriental fruit fly *Bactrocera dorsalis* Hendel (Diptera: Tephritidae) found infesting fruits in the Konkan region of Maharashtra. (Chaudhari *et al*., 2003). The Oriental fruit fly *Bactrocera dorsalis* Hendel and the guava fruit fly *Bactrocera correcta* Bezzi are the two main fruit fly species in the mango ecosystem in India (Kapoor, 1993). Both these are attracted to the parapheromone, methyl eugenol which is used in traps for monitoring and management (Verghese *et al*., 2006). In Karnataka, the more common species of fruit fly infesting mango fruits are *B. dorsalis*, *B. correcta*, and *B. zonata* (Verghese and Sudha Devi 1998). The present study is on the peak activity of fruit flies in *Garcinia* spp. in representative Kokum growing tracts in Uttara Kannada district of Karnataka.

MATERIALS AND METHODS

The study was taken on three *Garcinia spp. viz Garcinia indica*, *G. morella* and *G. gummigutta* at Sirsi and Katagal villages of Uttara Kannada District in standard metrological week (SMW)1 to 27 during 2021 and 2022. The fruit flies were caught by using locally made methyl eugenol traps (transparent one-liter mineral water bottle-30 cm height x 10 cm diameter) placed in two locations. The lure consisting of alcohol, methyl eugenol and malathion [6 part alcohol, 4 part methyl eugenol (4-allyl-1,2 –dimethoxy benzene-carboxylate) and 1 part malathion] was placed in a cotton rope of 2-inch size wrapped with aluminum foil one side provided in the trap. Each trap has four raised holes at the upper side of trap to allow the entry of flies. Male flies were attracted by the lures and these get killed immediately by the insecticide when they touch

the lure. The lures were recharged at monthly interval. The trapped fruit flies were counted from each trap and collected at fortnight interval and carefully transferred to butter paper covers. The fruit flies were sorted out in the laboratory and identified the species as per the taxonomic key provided by David and Ramani (2011). Three traps were hung in the outer and lower branches of the each selected *Garcinia* spp. trees, with a distance of 50 m between each trap at about 2 m height above the ground during the fruiting period of *Garcinia* spp. (January to June). The counts obtained at fortnightly intervals were analyzed as per statistical methodology detailed in Gomez and Gomez (1983).

RESULTS AND DISCUSSION

The results on the trap catches revealed the occurrence of *B. dorsalis B. correcta*, *B. zonata* and *B. versicolour* showing considerable variations during 2021 and 2022 of standard metrological week (SMW) of 1 to 27 in *Garcina* spp *viz.*, *Garcinia indica*, *G. morella* and *G. gummigutta*. In the *G. indica* the lowest population of *B. dorsalis* catch during 27th SMW of 2021 (5.23 flies/ trap) and (4.35 flies/trap) of SMW of 1st during 2022 and the maximum catch (200.00 flies/ trap) and (210.25 flies/ trap) during 15th SMW of 2021 and 2022 in Sirsi location. In Katagal location, the lowest population of *B. dorsalis* catch (7.25 flies/trap) and (8.25 flies/trap) during 27th SMW of 2021 and 2022 and the maximum peak catch (221.12 flies/trap) and (215.25 flies/ trap) during 15th SMW of 2021 and 2022 was recorded and the maximum trap captures coincided with peak fruiting period. Similarly, *B. correcta* lowest population catch (2.40 flies/trap) and (3.42 flies/trap) of 1st SMW of 2021 and 2022 and the maximum catch (145.25 flies/trap) and (165.00 flies/ trap) during 15th SMW of 2021 and 2022 in Sirsi and in the Katagal location the lowest catch (2.25 flies/trap) and (3.25 flies/trap) during 27th SMW of 2021 and 2022. The maximum catch (135.25 flies/trap) and (139.25 flies/trap) during 15th SMW of 2021 and 2022 and the maximum trap captures coincided with peak fruiting period. The population declined gradually in the *B. zonata*, the lowest (0.12 flies/trap) during 27th SMW of 2021 and (0.25 flies/trap) of SMW of 1st during 2022 and the maximum catch (5.25 flies/ trap) and (6.25 flies/trap) during 15th SMW of 2021 and 2022 in Sirsi location. In Katagal location the lowest *B. zonata* catch (0.25 flies/ trap) and (0.45 flies/ trap) during 3rd SMW of 2021 and 2022 and the maximum peak catch (6.89 flies/ trap) of SMW of 15th during 2021 and (7.45 flies/trap) during 13th SMW of 2022. The catches declined trend was observed in the *B. versicolour* the lowest (0.10 flies/trap) during 3rd SMW of 2021 and 2022. The maximum catch (1.50 flies/trap) and (2.50 flies/trap) during 11th SMW of 2021 and 2022 in Sirsi location. In Katagal location the lowest *B. versicolour* catch (0.11 flies/trap) during 27th SMW of 2021 and 1st SMW of 2022 respectively and the maximum peak catch (2.50 flies/trap) and (2.99 flies/trap) of SMW of 11th during 2021 and 2022 in katgal location in *G. indica* (Table 1).

In *G. morella* the lowest *B. dorsalis* catch of (3.25 flies/trap) and (2.25 flies/trap) of SMW of 27th during 2021 and 2022 and the maximum catch (88.58 flies/ trap) and (85.25 flies/ trap) during 15th SMW of 2021 and 2022 in Sirsi location. In Katagal location the lowest *B. dorsalis* catch (4.25 flies/trap) and (3.21flies/trap) during 27th SMW of 2021 and 2022 and the maximum peak catch (95.65 flies/trap) and (90.12 flies/ trap) during 15th SMW of 2021 and 2022 and the maximum trap captures coincided with peak fruiting period of *G. morella*. Similarly, *B. correcta* lowest catch (1.45 flies/ trap) during 1st SMW of 2021 and (1.25 flies/ trap) of 27th SMW of 2022 and the maximum catch (78.78 flies/trap) and (70.14 flies/trap) during 15th SMW of 2021 and 2022 in Sirsi location and in the Katagal location the lowest catch (2.25 flies/trap) and (1.65 flies/trap) during 1st SMW of 2021 and 2022. The maximum catch (70.15 flies/trap) and (65.65 flies/trap) during 15th SMW of 2021 and 2022 and the maximum trap captures coincided with peak fruiting period. The catches declined gradually in the *B. zonata* the lowest (0.10 flies/ trap) during 27th SMW of 2021 and 2022 and the maximum catch (4.52 flies/trap) and (3.25 flies/trap) during 15th SMW of 2021 and 2022 in Sirsi location. In Katagal location the lowest *B. zonata* catch (0.87 flies/trap) during 27th SMW of 2021 and (0.11 flies/trap) during 3rd SMW of 2022 and the maximum peak catch (5.51 flies/trap) and (6.47 flies/trap) of SMW of 15th during 2021 and 2022. The *B. versicolour* trap caches were very low in both locations and accounts only 0.15 to 0.33 per cent during 2021 and 2022. (Table 2).

In *G. gummigutta* the lowest *B. dorsalis* catch of (1.00 flies/trap) during 1st SMW of 2021 and (1.36 flies/trap) of SMW of 3rd during 2022 and the maximum catch (18.85 flies/trap) and (22.36 flies/trap) during 19th SMW of 2021 and 2022 in Sirsi location. In Katagal location the lowest *B. dorsalis* catch (0.11 flies/trap) during 3rd SMW of 2021 and (0.10 flies/trap) during 5th SMW of 2022 and the maximum peak catch (21.25 flies/trap) and (24.25 flies/ trap) during 19th SMW of 2021 and 2022 and the maximum trap captures coincided with peak fruiting period of *G. gummigutta*. Similarly, *B. correcta* lowest catch (0.11 flies/trap) during 5th SMW of 2021 and (0.45 flies/ trap) of 27th SMW of 2022 and the maximum catch (8.25 flies/trap) and (9.57 flies/trap) during 19th SMW of 2021 and 2022 in Sirsi location and in the Katagal location the lowest catch (0.10 flies/trap) and (0.75 flies/trap) during 127th SMW of 2021 and 2022. The maximum catch (9.25 flies/trap) and (10.89 flies/trap) during 19th SMW of 2021 and 2022. The *B. zonata* trap caches were very low in both the locations. The fruit flies species *B. versicolour* not reported in *G. gummigutta* in both locations during 2021 and 2022. (Table3). In our study these results are in conformity with the findings of Gajalakshmi *et al*. (2011) who observed a peak of *B. dorsalis* during June. Bansode and Patel (2018) also reported similar trend from South Gujarat, while Verghese and Sudhadevi (1998) observed peak occurrence in June and August. The present observations agree with those of Nair (1995) on *B. dorsalis* that peak was during June to July; and those of Ravikumar and Viraktamath (2006); Ranjitha and

Viraktamath (2006) who observed that *B. dorsalis* occurred in mango orchard at Dharwad, during late July. In case of *B. correcta*, findings are in line with those of Suresh Babu and Viraktamath (2003), and contradictory to those of Gajalakshmi *et al*. (2011) who reported that *B. correcta* peak occurrence was during May at Coimbatore, Kanyakumari and Paiyur. The peak trap caches with fruiting period in local mango crop was similarly reported by Sarada *et al*. (2001) with maximum fly catches from May to July coinciding with the fruit maturity period at Tirupati in Andhra Pradesh.

The abundance of fruit flies results indicated that the peak trap caches of fruit flies were coincided with the ripening of *Garcinia indica*, *G. morella* and *G. gummigutta* fruits and *B. dorsalis* was more dominant followed by *B. correcta*, *B. zonata* and *B. versicolour*. The populations of trap caches of fruit flies were high in the *Garcinia indica* compare to other two *Garcinia* species may be due to the long period of fruits that are acceptable for egg laying than *G. morella* and *G. gummigutta* (Tabe 4, Fig. 1-3). Drew and Hooper (1983) stated that the fruit flies tend to remain or very near fruiting host plants so long as the fruit is acceptable for egg laying. If the plants are non-host or hosts with low quality fruit, the mature females arrive in low numbers and or emigrate rather rapidly, and in some species may fly considerable distance before finding host plants with acceptable fruits. Aluja *et al.* (1996) who found direct relation of fruit fly abundance with the availability of host fruits. The length of fruiting period also indicated a significant influence on the occurrence of the *Bactrocera* spp. Moreover, volatiles from ripened fruit serve as a mean to attract more flies to the orchards (Ye, 2008).

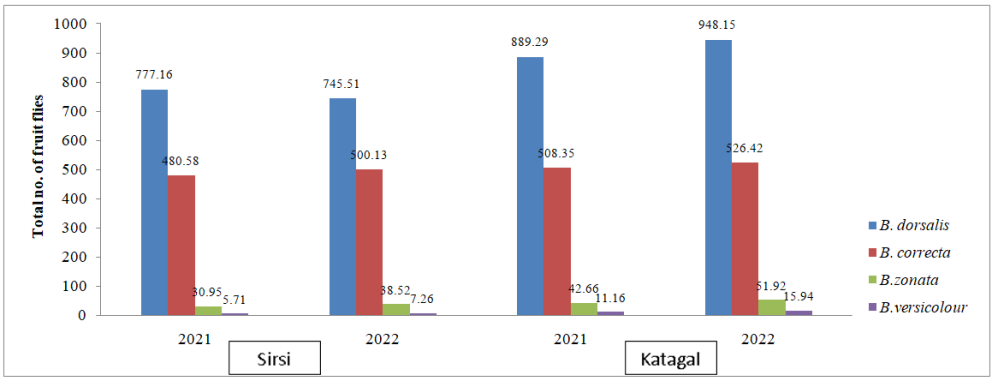

Fig. 1. Abundance of fruit flies in *Garcinia indica* during 2021 and 2022.

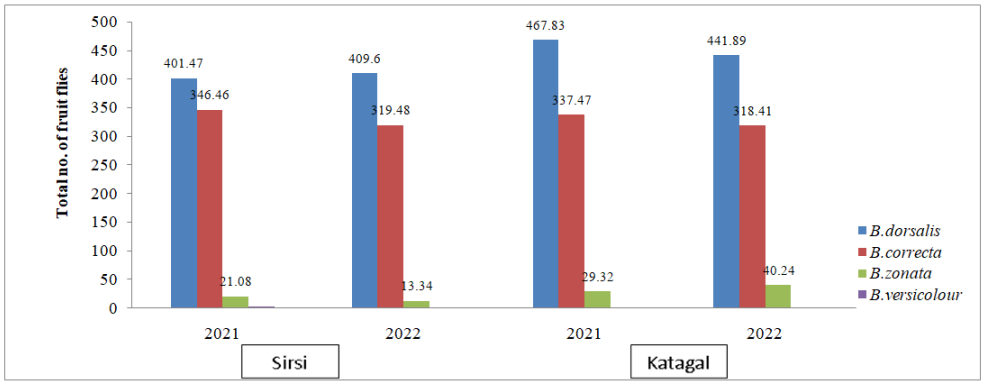

Fig. 2. Abundance of fruit flies in *Garcinia morella* during 2021 and 2022.

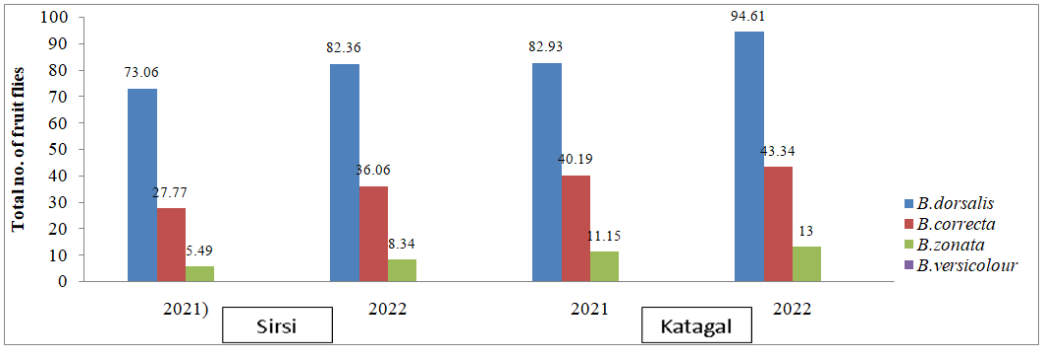

Fig. 3. Abundance of fruit flies in *Garcinia gummigutta* during 2021 and 2022.

Table 1: Mean number of fruit flies species trapped in *Garcinia indica* during 2021 and 2022.

	Mean trap catches per fortnight interval *										Mean trap catches per fortnight interval *									
	Sirsi										Katagal									
	Bactrocera dorsalis		*Bactrocera correcta*		*Bactrocera zonata*		*Bactrocera versicolour*		Total		*Bactrocera dorsalis*		*Bactrocera correcta*		*Bactrocera zonata*		*Bactrocera versicolour*		Total	
SMW	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**
1	5.87 (2.52)	4.35 (2.2)	2.40 (1.7)	3.42 (1.98)	0.20 (0.84)	0.25 (0.87)	0.00 (0.71)	0.12 (0.79)	8.47 (2.99)	8.14 (2.94)	8.58 (3.01)	9.25 (3.12)	3.45 (1.99)	4.58 (2.25)	0.53 (1.01)	0.78 (1.13)	0.00 (0.71)	0.11 (0.78)	12.56 (3.61)	14.72 (3.9)
3	8.45 (2.99)	6.45 (2.64)	6.25 (2.6)	5.25 (2.4)	0.30 (0.89)	0.45 (0.97)	0.10 (0.77)	0.10 (0.77)	15.10 (3.95)	12.25 (3.57)	12.23 (3.57)	11.25 (3.43)	8.25 (2.96)	11.25 (3.43)	0.25 (0.87)	0.45 (0.97)	0.00 (0.71)	0.10 (0.77)	20.73 (4.61)	23.05 (4.85)
5	12.28 (3.57)	13.25 (3.71)	9.10 (3.1)	8.15 (2.94)	0.80 (1.14)	0.95 (1.2)	0.00 (0.71)	0.00 (0.71)	22.18 (4.76)	22.35 (4.78)	15.15 (3.96)	14.25 (3.84)	11.25 (3.43)	13.25 (3.71)	1.25 (1.32)	1.98 (1.57)	0.00 (0.71)	0.00 (0.71)	27.65 (5.31)	29.48 (5.48)
7	15.80 (4.04)	18.96 (4.41)	13.00 (3.67)	14.25 (3.84)	1.85 (1.53)	1.96 (1.57)	1.20 (1.3)	1.20 (1.3)	31.85 (5.69)	36.37 (6.07)	18.25 (4.33)	19.25 (4.44)	15.25 (3.97)	16.25 (4.09)	2.25 (1.66)	3.25 (1.94)	2.20 (1.64)	2.65 (1.77)	37.95 (6.20)	41.40 (6.47)
9	41.60 (6.49)	44.60 5(6.72)	43.1 (6.6)	44.45 (6.7)	5.14 (2.37)	6.45 (2.64)	0.00 (0.71)	0.10 (0.77)	89.84 (9.5)	95.65 (9.81)	45.23 (6.76)	48.58 (7.01)	46.58 (6.86)	49.25 (7.05)	6.25 (2.6)	7.89 (2.9)	1.1 (1.26)	1.98 (1.57)	99.16 (9.98)	107.7 (10.40)
11	75.23 (8.7)	85.00 (9.25)	64.40 (8.06)	63.25 (7.98)	3.60 (2.02)	4.58 (2.25)	1.50 (1.41)	2.40 (1.7)	144.73 (12.05)	155.23 (12.48)	79.25 (8.93)	85.58 (9.28)	74.25 (8.65)	77.25 (8.82)	4.25 (2.18)	5.36 (2.42)	2.5 (1.73)	2.99 (1.87)	160.25 (12.68)	171.18 (13.10)
13	142.00 (11.94)	184.23 (13.59)	84.40 (9.21)	82.32 (9.1)	4.89 (2.32)	5.68 (2.49)	0.00 (0.71)	0.11 (0.78)	231.29 (15.22)	272.34 (16.52)	165.00 (12.86)	189.99 (13.8)	88.26 (9.42)	85.58 (9.28)	6.25 (2.6)	7.45 (2.82)	1.25 (1.32)	1.56 (1.44)	260.76 (16.16)	284.58 (16.88)
15	200.00 (14.16)	210.25 (14.52)	145.00 (12.06)	165.00 (12.86)	5.25 (2.4)	6.25 (2.6)	1.00 (1.22)	1.25 (1.32)	351.25 (18.75)	382.75 (19.58)	221.12 (14.89)	215.25 (14.69)	135.25 (11.65)	139.25 (11.82)	6.89 (2.72)	7.12 (2.76)	1.25 (1.32)	1.58 (1.44)	364.51 (19.11)	363.2 (19.07)
17	175.00 (13.25)	83.25 (9.15)	51.12 (7.18)	52.25 (7.26)	3.8 (2.07)	4.52 (2.24)	0.00 (0.71)	0.00 (0.71)	229.92 (15.18)	140.02 (11.85)	185.23 (13.63)	195.56 (14)	58.25 (7.66)	55.25 (7.47)	5.25 (2.4)	6.25 (2.6)	0.00 (0.71)	1.00 (1.22)	248.73 (15.79)	258.06 (16.08)
19	46.40 (6.85)	44.45 (6.7)	23.10 (4.86)	24.25 (4.97)	2.80 (1.82)	3.25 (1.94)	0.50 (1.00)	0.50 (1.00)	72.80 (8.56)	72.45 (8.54)	77.25 (8.82)	88.85 (9.45)	25.36 (5.09)	27.25 (5.27)	3.58 (2.02)	4.12 (2.15)	0.75 (1.12)	0.75 (1.12)	106.94 (10.37)	120.97 (11.02)
21	24.40 (4.99)	23.52 (4.9)	18.15 (4.32)	16.45 (4.12)	1.40 (1.38)	2.40 (1.70)	1.00 (1.22)	1.00 (1.22)	44.95 (6.74)	43.37 (6.62)	27.25 (5.27)	29.26 (5.46)	19.25 (4.44)	19.36 (4.46)	2.45 (1.72)	2.78 (1.81)	1.25 (1.32)	1.87 (1.54)	50.20 (7.12)	53.27 (7.33)
23	16.50 (4.12)	15.45 (3.99)	11.1 (3.41)	11.59 (3.48)	0.40 (0.95)	0.64 (1.07)	0.00 (0.71)	0.25 (0.87)	28.00 (5.34)	27.93 (5.33)	18.25 (4.33)	21.25 (4.66)	13.45 (3.73)	15.87 (4.05)	1.25 (1.32)	1.56 (1.44)	0.00 (0.71)	0.00 (0.71)	32.95 (5.78)	38.68 (6.26)
25	8.40 (2.98)	6.45 (2.64)	6.21 (2.59)	5.25 (2.4)	0.40 (0.95)	0.59 (1.04)	0.30 (0.89)	0.11 (0.78)	15.31 (3.98)	12.40 (3.59)	9.25 (3.12)	11.58 (3.48)	7.25 (2.78)	8.78 (3.05)	1.11 (1.27)	1.56 (1.44)	0.75 (1.12)	0.88 (1.17)	18.36 (4.34)	22.80 (4.83)
27	5.20 3(2.39)	5.25 (2.4)	3.25 (1.94)	4.25 (2.18)	0.12 (0.79)	0.55 (1.02)	0.11 (0.78)	0.12 (0.79)	8.71 (3.03)	10.17 (3.27)	7.25 (2.78)	8.25 (2.96)	2.25 (1.66)	3.25 (1.94)	1.10 (1.26)	1.37 (1.37)	0.11 (0.78)	0.47 (0.98)	10.71 (3.35)	13.34 (3.72)
Total	**777.16 (27.89)**	**745.5 1(27.31)**	**480.58 (21.93)**	**500.13 (22.37)**	**30.95 (5.61)**	**38.52 (6.25)**	**5.71 (2.49)**	**7.26 (2.79)**	**1294.4 (35.98)**	**1291.42 (35.94)**	**889.29 (29.83)**	**948.15 (30.8)**	**508.35 (22.56)**	**526.42 (22.95)**	**42.66 (6.57)**	**51.92 (7.24)**	**11.16 (3.41)**	**15.94 (4.05)**	**1451.46 (38.1)**	**1542.43 (39.28)**
Mean	**55.51**	**53.25**	**34.32**	**35.72**	**2.21**	**2.75**	**0.40**	**0.51**			**63.52**	**67.72**	**36.31**	**37.60**	**3.047**	**3.70**	**0.79**	**1.13**		
Trapped (%)	**60.04**	**57.72**	**37.12**	**38.72**	**2.39**	**2.98**	**0.44**	**0.56**			**61.26**	**61.47**	**35.02**	**34.12**	**2.93**	**3.36**	**0.76**	**1.03**		

* Average of three traps

Figures in parenthesis are $\sqrt{x}+0.5$ transformed values.

Table 2: Mean number of fruit flies species trapped in *Garcinia morella* during 2021 and 2022.

	Mean trap catches per fortnight interval *										Mean trap catches per fortnight interval *									
	Sirsi										Katagal									
	Bactrocera dorsalis		*Bactrocera correcta*		*Bactrocera zonata*		*Bactrocera versicolour*		Total		*Bactrocera dorsalis*		*Bactrocera correcta*		*Bactrocera zonata*		*Bactrocera versicolour*		Total	
STD Week	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**
1	3.45 (1.99)	2.45 (1.72)	1.45 (1.4)	1.89 (1.55)	0.11 (0.78)	0.11 (0.78)	0.00 (0.71)	0.11 (0.78)	5.01 (2.35)	4.56 (2.25)	5.56 (2.46)	3.25 (1.94)	2.25 (1.66)	1.65 (1.47)	0.58 (1.04)	0.78 (1.13)	0.00 (0.71)	0.00 (0.71)	8.39 (2.98)	5.68 (2.49)
3	5.65 (2.48)	4.56 (2.25)	4.45 (2.22)	5.52 (2.45)	0.25 (0.87)	0.10 (0.77)	0.10 (0.77)	0.00 (0.71)	10.45 (3.31)	10.18 (3.27)	6.68 (2.68)	5.56 (2.46)	3.58 (2.02)	2.58 (1.75)	0.78 (1.13)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	11.04 (3.4)	8.25 (2.96)
5	6.25 (2.6)	5.52 (2.45)	8.45 (2.99)	9.45 (3.15)	0.21 (0.84)	0.12 (0.79)	0.10 (0.77)	0.00 (0.71)	15.01 (3.94)	15.09 (3.95)	7.89 (2.9)	6.98 (2.73)	9.25 (3.12)	8.87 (3.06)	0.64 (1.07)	0.66 (1.08)	0.00 (0.71)	0.00 (0.71)	17.78 (4.28)	16.51 (4.12)
7	12.23 (3.57)	11.25 (3.43)	6.45 (2.64)	7.52 (2.83)	0.85 (1.16)	0.66 (1.08)	0.10 (0.77)	0.10 (0.77)	19.63 (4.49)	19.53 (4.48)	15.68 (4.02)	13.25 (3.71)	7.59 (2.84)	6.87 (2.71)	1.25 (1.32)	1.87 (1.54)	0.00 (0.71)	0.00 (0.71)	24.52 (5)	21.99 (4.74)
9	34.12 (5.88)	35.58 (6.01)	34.25 (5.89)	32.25 (5.72)	3.45 (1.99)	2.25 (1.66)	0.00 (0.71)	0.00 (0.71)	71.82 (8.50)	70.08 (8.40)	39.41 (6.32)	35.56 (6)	39.58 (6.33)	35.65 (6.01)	4.41 (2.22)	5.56 (2.46)	0.00 (0.71)	0.00 (0.71)	83.40 (9.16)	76.77 (8.79)
11	45.45 (6.78)	48.58 (7.01)	55.58 (7.49)	52.25 (7.26)	2.52 (1.74)	1.25 (1.32)	0.75 (1.12)	0.12 (0.79)	104.3 (10.24)	102.2 (10.13)	52.23 (7.26)	51.96 (7.24)	59.25 (7.73)	56.69 (7.56)	3.25 (1.94)	4.89 (2.32)	0.00 (0.71)	0.00 (0.71)	114.73 (10.73)	113.54 (10.68)
13	75.15 (8.7)	78.85 (8.91)	55.25 (7.47)	53.25 (7.33)	3.85 (2.09)	2.25 (1.66)	0.00 (0.71)	0.00 (0.71)	134.25 (11.61)	134.35 (11.61)	87.59 (9.39)	85.98 (9.3)	49.57 (7.08)	48.89 (7.03)	4.25 (2.18)	5.65 (2.48)	0.14 (0.8)	0.00 (0.71)	141.55 (11.92)	140.52 (11.88)
15	88.58 (9.44)	85.25 (9.26)	78.78 (8.9)	70.14 (8.4)	4.52 (2.24)	3.25 (1.94)	1.00 (1.22)	0.10 (0.77)	172.88 (13.17)	158.74 (12.62)	95.65 (9.81)	90.12 (9.52)	70.15 (8.41)	65.65 (8.13)	5.51 (2.45)	6.47 (2.64)	0.00 (0.71)	1.25 (1.32)	171.31 (13.11)	163.49 (12.81)
17	66.58 (8.19)	73.25 (8.59)	66.55 (8.19)	56.35 (7.54)	2.50 (1.73)	1.25 (1.32)	0.00 (0.71)	0.00 (0.71)	135.63 (11.67)	130.85 (11.46)	79.25 (8.93)	77.89 (8.85)	61.25 (7.86)	59.87 (7.77)	3.25 (1.94)	4.89 (2.32)	0.00 (0.71)	0.00 (0.71)	143.75 (12.01)	142.65 (11.96)
19	34.25 (5.89)	35.58 (6.01)	13.25 (3.71)	12.25 (3.57)	1.75 (1.5)	1.12 (1.27)	0.11 (0.78)	0.14 (0.8)	49.36 (7.06)	49.09 (7.04)	39.25 (6.3)	36.65 (6.1)	12.36 (3.59)	11.35 (3.44)	2.32 (1.68)	3.14 (1.91)	0.00 (0.71)	0.00 (0.71)	53.93 (7.38)	51.14 (7.19)
21	13.35 (3.72)	14.52 (3.88)	9.25 (3.12)	8.45 (2.99)	0.75 (1.12)	0.66 (1.08)	0.12 (0.79)	0.12 (0.79)	23.47 (4.9)	23.75 (4.92)	14.56 (3.88)	13.25 (3.71)	8.88 (3.06)	7.77 (2.88)	1.11 (1.27)	2.10 (1.61)	0.12 (0.79)	0.00 (0.71)	24.67 (5.02)	23.12 (4.86)
23	8.58 (3.01)	8.11 (2.93)	7.25 (2.78)	6.66 (2.68)	0.12 (0.79)	0.11 (0.78)	0.00 (0.71)	0.11 (0.78)	15.95 (4.06)	14.99 (3.94)	12.58 (3.62)	11.87 (3.52)	6.25 (2.6)	6.21 (2.59)	1.10 (1.26)	1.00 (1.22)	0.00 (0.71)	0.00 (0.71)	19.93 (4.52)	19.08 (4.42)
25	4.58 (2.25)	3.85 (2.09)	3.25 (1.94)	2.25 (1.66)	0.10 (0.77)	0.11 (0.78)	0.21 (0.84)	0.21 (0.84)	8.14 (2.94)	6.42 (2.63)	7.25 (2.78)	6.36 (2.62)	4.26 (2.18)	3.25 (1.94)	0.00 (0.71)	1.25 (1.32)	0.21 (0.84)	0.00 (0.71)	11.72 (3.5)	10.86 (3.37)
27	3.25 (1.94)	2.25 (1.66)	2.25 (1.66)	1.25 (1.32)	0.10 (0.77)	0.10 (0.77)	0.11 (0.78)	0.11 (0.78)	5.71 (2.49)	3.71 (2.05)	4.25 (2.18)	3.21 (1.93)	3.25 (1.94)	3.11 (1.9)	0.87 (1.17)	1.87 (1.54)	0.11 (0.78)	0.00 (0.71)	8.48(3)	8.19 (2.95)
Total	**401.47 (20.05)**	**409.6 (20.25)**	**346.46 (18.63)**	**319.48 (17.89)**	**21.08 (4.65)**	**13.34 (3.72)**	**2.6 (1.76)**	**1.12 (1.27)**	**771.16 (27.78)**	**743.54 (27.28)**	**467.83 (21.64)**	**441.89 (21.03)**	**337.47 (18.38)**	**318.41 (17.86)**	**29.32 (5.46)**	**40.24 (6.38)**	**0.58 (1.04)**	**1.25 (1.32)**	**835.2 (28.91)**	**801.79 (28.32)**
Mean	**28.67**	**29.25**	**24.74**	**22.82**	**1.50**	**0.95**	**0.18**	**0.08**			**33.41**	**31.56**	**24.10**	**22.74**	**2.09**	**2.87**	**0.04**	**0.08**		
Trapped (%)	**52.03**	**55.08**	**44.90**	**42.96**	**2.73**	**1.79**	**0.33**	**0.15**			**56.01**	**55.11**	**40.40**	**39.71**	**3.51**	**5.01**	**0.06**	**0.15**		

* Average of three traps; Figures in parenthesis are $\sqrt{x}+0.5$ transformed values.

Table 3: Mean number of fruit flies species trapped in *Garcinia gummigutta* during 2021 and 2022.

	Mean trap catches per fortnight interval *										Mean trap catches per fortnight interval *									
	Sirsi										Katagal									
	Bactrocera dorsalis		*Bactrocera correcta*		*Bactrocera zonata*		*Bactrocera versicolour*		Total		*Bactrocera dorsalis*		*Bactrocera correcta*		*Bactrocera zonata*		*Bactrocera versicolour*		Total	
STD Week	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**
1	1.00 (1.22)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.00 (1.22)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
3	1.20 (1.3)	1.36 (1.36)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.20 (1.3)	1.36 (1.36)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.11 (0.78)	0.00 (0.71)
5	1.25 (1.32)	1.89 (1.55)	0.11 (0.78)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.36 (1.36)	1.89 (1.55)	0.00 (0.71)	0.10 (0.77)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.10 (0.77)
7	1.53 (1.42)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	1.53 (1.42)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
9	1.58 (1.44)	2.11 (1.62)	1.23 (1.32)	1.55 (1.43)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	2.81 (1.82)	3.66 (2.04)	0.10 (0.77)	0.58 (1.04)	2.25 (1.66)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	2.35 (1.69)	0.58 (1.04)
11	5.25 (2.4)	3.25 (1.94)	4.25 (2.18)	5.69 (2.49)	0.10 (0.77)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	9.60 (3.18)	8.94 (3.07)	6.89 (2.72)	5.65 (2.48)	6.58 (2.66)	6.87 (2.71)	0.89 (1.18)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	14.36 (3.85)	12.52 (3.61)
13	6.89 (2.72)	7.78 (2.88)	2.56 (1.75)	3.58 (2.02)	1.25 (1.32)	1.41 (1.38)	0.00 (0.71)	0.00 (0.71)	10.7 (3.35)	12.77 (3.64)	7.99 (2.91)	8.89 (3.06)	3.25 (1.94)	4.58 (2.25)	2.25 (1.66)	2.58 (1.75)	0.00 (0.71)	0.00 (0.71)	13.49 (3.74)	16.05 (4.07)
15	7.89 (2.9)	8.99 (3.08)	2.36 (1.69)	3.15 (1.91)	0.12 (0.79)	1.58 (1.44)	0.00 (0.71)	0.00 (0.71)	10.37 (3.3)	13.72 (3.77)	8.89 (3.06)	14.25 (3.84)	3.35 (1.96)	4.89 (2.32)	0.87 (1.17)	2.78 (1.81)	0.00 (0.71)	0.00 (0.71)	13.11 (3.69)	21.92 (4.73)
17	8.89 (3.06)	11.25 (3.43)	1.01 (1.23)	1.89 (1.55)	0.00 (0.71)	1.11 (1.27)	0.00 (0.71)	0.00 (0.71)	9.90 (3.22)	14.25 (3.84)	11.25 (3.43)	13.58 (3.75)	2.14 (1.62)	2.25 (1.66)	0.00 (0.71)	1.55 (1.43)	0.00 (0.71)	0.00 (0.71)	13.39 (3.73)	17.38 (4.23)
19	18.85 (4.4)	22.36 (4.78)	8.25 (2.96)	9.57 (3.17)	3.25 (1.94)	2.58 (1.75)	0.00 (0.71)	0.00 (0.71)	30.35 (5.55)	34.51 (5.92)	21.25 (4.66)	24.25 (4.97)	9.25 (3.12)	10.89 (3.37)	4.25 (2.18)	3.54 (2.01)	0.00 (0.71)	0.00 (0.71)	34.75 (5.94)	38.68 (6.26)
21	7.12 (2.76)	8.45 (2.99)	5.56 (2.46)	6.35 (2.62)	0.66 (1.08)	0.78 (1.13)	0.00 (0.71)	0.00 (0.71)	13.34 (3.72)	15.58 (4.01)	8.89 (3.06)	9.25 (3.12)	7.85 (2.89)	7.89 (2.9)	2.31 (1.68)	0.99 (1.22)	0.00 (0.71)	0.00 (0.71)	19.05 (4.42)	18.13 (4.32)
23	5.25 (2.4)	7.89 (2.9)	2.23 (1.65)	3.35 (1.96)	0.11 (0.78)	0.74 (1.11)	0.00 (0.71)	0.00 (0.71)	7.59 (2.84)	11.98 (3.53)	7.89 (2.9)	9.25 (3.12)	3.25 (1.94)	4.44 (2.22)	0.58 (1.04)	0.79 (1.14)	0.00 (0.71)	0.00 (0.71)	11.72 (3.5)	14.48 (3.87)
25	3.25 (1.94)	4.25 (2.18)	0.11 (0.78)	0.48 (0.99)	0.00 (0.71)	0.14 (0.8)	0.00 (0.71)	0.00 (0.71)	3.36 (1.96)	4.87 (2.32)	5.56 (2.46)	5.56 (2.46)	2.17 (1.63)	0.78 (1.13)	0.00 (0.71)	0.77 (1.13)	0.00 (0.71)	0.00 (0.71)	7.73 (2.87)	7.11 (2.76)
27	3.11 (1.9)	2.78 (1.81)	0.10 (0.77)	0.45 (0.97)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	3.21 (1.93)	3.23 (1.93)	4.11 (2.15)	3.25 (1.94)	0.10 (0.77)	0.75 (1.12)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	4.21 (2.17)	4.00 (2.12)
Total	**73.06 (8.58)**	**82.36 (9.1)**	**27.77 (5.32)**	**36.06 (6.05)**	**5.49 (2.45)**	**8.34 (2.97)**	**0 (0.71)**	**0 (0.71)**	**106.32 (10.34)**	**126.76 (11.28)**	**82.93 (9.13)**	**94.61 (9.75)**	**40.19 (6.38)**	**43.34 (6.62)**	**11.15 (3.41)**	**13 (3.67)**	**0 (0.71)**	**0 (0.71)**	**134.27 (11.61)**	**150.95 (12.31)**
Mean	**5.21**	**5.88**	**1.98**	**2.57**	**0.39**	**0.59**	**0.00**	**0.00**			**5.92**	**6.75**	**2.87**	**3.09**	**0.79**	**0.92**	**0**	**0**		
Trapped (%)	**68.71**	**64.97**	**26.11**	**28.44**	**5.16**	**6.57**	**0.00**	**0.00**			**61.76**	**62.67**	**29.93**	**28.71**	**8.30**	**8.61**	**0**	**0**		

* Average of three traps; Figures in parenthesis are $\sqrt{x}+0.5$ transformed values.

Table 4: Abundance of fruit flies trap catches in *Garcinia* spp during 2021 and 2022

	Garcinia indica* (trap catches)				***Garcinia morella* (trap catches) ***				***Garcinia gummigutta* (trap catches) ***			
	2021	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**	**2021**	**2022**
	Sirsi		**Katagal**		**Sirsi**		**Katagal**		**Sirsi**		**Katagal**	
Bactrocera dorsalis	777.16	745.51	889.29	948.15	401.47	409.6	467.83	441.89	73.06	82.36	82.93	94.61
Bactrocera correcta	480.58	500.13	508.35	526.42	346.46	319.48	337.47	318.41	27.77	36.06	40.19	43.34
Bactrocera zonata	30.95	38.52	42.66	51.92	21.08	13.34	29.32	40.24	5.49	8.34	11.15	13.00
Bactrocera versicolour	5.71	7.26	11.16	15.94	2.6	1.12	0.58	1.25	0.00	0.00	0.00	0.00
Total	**1294.4**	**1291.42**	**1451.46**	**1542.43**	**771.16**	**743.54**	**835.2**	**801.79**	**106.32**	**126.76**	**134.27**	**150.95**

* Average of three traps

CONCLUSIONS

In conclusion of the present research findings, the population of fruit flies fluctuated during the fruiting period in *Garcinia* spp. and *B. dorsalis* appeared to be the most abundant species as compared to *B. correcta*, *B. zonata* and *B. versicolour*.

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