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RESPONSE OF FRUIT FLY, *BACTROCERA* SPP. TO DIFFERENT COLOUR TRAPS AND ATTRACTANTS

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ABSTRACT

Chemical insecticides have hazardous effects on human health and the ecosystem hence, there is a dire need of the hour to use nonchemical eco-friendly tactics for the management of major insect pests. While, the use of traps and other attract-and-kill devices in pest management strategies to reduce fruit fly populations has proved to be efficient, therefore the current study was designed to evaluate different coloured fruit fly traps and attractant combinations for trapping and eco-friendly management of fruit fly (*Bactrocera* spp.) in guava orchard at University of Agricultural Sciences, Dharwad. Among the tested traps, yellow and orange bottle traps trapped the highest number of fruit flies. Similarly, for different attractants, tulsi extract traps trapped the highest number of fruit flies. While among different colour and attractant combinations, yellow trap with tulsi extract and orange trap with tulsi extract trapped the highest number of fruit flies.

Key words : Attractant, Eco-friendly, Fruit fly, Traps, Tulsi extract.

Introduction

Fruit flies (Diptera: Tephritidae) are found in tropical and sub-tropical regions throughout the world and cause huge economic losses while infesting major fruit and vegetable crops and not only do they cause direct damage to horticultural crops, but also retard agricultural development and trade in many countries due to strict quarantines for agricultural trade (Fazlullah *et al*., 2015). As the demand for the quality of fruits and vegetables is increasing day by day, many exporting and importing countries give special attention to the management of fruit flies at the pre-harvest and post-harvest stages. The fruit fly genus *Bactrocera* contains more than 500 invasive, polyphagous species that infest fruits and vegetables throughout the globe and causes severe economic damage, while sometimes *Bactrocera* spp. can cause 100 per cent losses to produce (Drew and Romig, 2013).

The practice of integrated pest management (IPM) is important because of its effectiveness and gains for the environment and health (Mondal *et al*., 2015; Khan *et al*., 2017); otherwise, the use of pesticides will keep increasing. According to Verghese *et al*. (2004), the practice of IPM to control *B. dorsalis* can give very high reductions of infestation. The array of control methods ranged from insecticide sprays to foliage and soil, bait-sprays, male annihilation techniques, releases of sterilized flies, parasitoids and cultural controls can be used. The males of some *Bactrocera* species are strongly attracted to different lures like methyl eugenol, raspberry ketone and cuelure and these volatile substances can attract male fruit flies at a distance of about 3 km. Therefore, farmers use these attractive traps for control of fruit flies' infestation in their fields (Iwahashi *et al*., 1996). Different stimuli including visual stimuli, colour and shape affect adult fruit flies' behaviour especially, while finding their host (Susanto *et al*., 2020). Thus, for effective control of fruit flies (*Bactrocera* spp.) by using different traps material, shape and other modifications need special attention (Eliopoulos, 2007). Various types of fruit fly traps have been developed for monitoring and

control purposes and the efficacy of these traps depends upon the attractant used, type of traps used and the light intensity (Singh and Sharma, 2013; Rizki *et al*., 2013). There are significant differences recorded in the efficacy of different traps (Navarro-Llopis *et al*., 2008), hence for effective management of the fruit fly population, appropriate selection of traps are indispensable (Navarro-Llopis *et al*., 2015). Therefore, the current study was conducted with the intent to determine the most effective colour trap and attractant combination for the eco-friendly management of *Bactrocera* spp. in guava orchard.

Materials and Methods

Cylindrical bottle traps at equal distance impregnated with an attractant were installed in the guava orchard at University of Agricultural Sciences, Dharwad. The traps were installed in an area of one acre. Study area is situated at Northern Transitional Zone of Karnataka (agro-climatic zone 8) at 15^0 26 North latitude and 70^0 07 East longitude. Fruits and tulsi leaves (5 g) were collected and grinded using pestle and mortar. 5% extract solution was prepared and then filtered using filter paper. Cotton was dipped in extract solution and hung. Spinetoram was used as a poison to kill the fruit flies inside the trap. Twelve trap combinations of different colours (white, yellow, orange and red) containing different attractants (banana extract, guava extract and tulsi extract) were installed randomly at a height of five feet from the ground on trees for a period of nine weeks from the first week of July 2022 up to the last week of August 2022 (Fig. 1).

Fig. 1 : Different colour traps used for trapping fruit flies a. white b. orange c. red d. yellow.

Each treatment was replicated three times and trapped fruit flies were collected and counted weekly. The data obtained in the experiment in the current investigation were subjected to square root transformation. Transformed values were analyzed using ANOVA for a Factorial Randomized Complete Block Design (FRCBD).

Results and Discussion

During the first week of sampling, the number of fruit flies attracted was more to yellow trap with tulsi extract (6/trap), orange trap with tulsi extract (5/trap) and yellow trap with guava extract (4.67/trap), which were on par with each other. The least number of fruit flies were trapped in white trap with banana extract (0/trap) and red trap with banana (1/trap). During the second week of sampling, more fruit flies were attracted to orange trap with tulsi extract and yellow trap with tulsi extract which were on par with each other followed by yellow trap with guava extract (5/trap). The least number of fruit flies were trapped in white trap with banana extract (0.33/trap) and red trap with banana extract (2.33/trap). During the third week of sampling, more fruit flies were attracted to yellow trap with tulsi extract (5.67/trap) and yellow trap with guava extract (5/trap), which were on par with each other followed by orange trap with tulsi extract (4.33/trap). The least number of fruit flies were trapped in white trap with banana extract (0.33/trap), white trap with guava extract (2/trap) and red trap with banana extract (2/trap). During the fourth week of sampling orange trap with tulsi extract (4.67/trap), yellow trap with tulsi extract (4.33/trap) and red trap with tulsi extract (4/trap) attracted more fruit flies which were on par with each other. White trap with banana extract (0.67/trap) attracted least number of fruit flies. During fifth week of sampling more fruit flies were attracted to yellow trap with tulsi extract (7.33/trap) followed by yellow trap with guava extract (4.67/trap) and orange trap with tulsi extract (4.33/trap), which were on par with each other. Least number of fruit flies were attracted to white trap with banana extract (0.33/trap) and red trap with banana extract (1.33/trap). During sixth week of sampling, yellow trap with tulsi extract (7/trap) attracted more fruit flies followed by orange trap with guava extract (4.67/trap) and orange trap with tulsi extract (4.67/trap), which were on par with each other. Least were recorded in white trap with banana extract (0.33/trap), white trap with guava extract (2/trap) and red trap with banana extract (2.33/trap).

During seventh week of sampling yellow trap with tulsi extract (7/trap), yellow trap with guava extract (4.67/trap) and orange trap with tulsi extract (4.67/trap) attracted more fruit flies, which were on par with each other. White trap with banana extract (0.33/trap) and red trap with banana extract (1.33/trap) attracted least number of fruit flies. During eighth week of sampling more fruit flies were attracted to yellow trap with tulsi extract (7.33/trap) followed by orange trap with tulsi extract (5.33/trap) and yellow trap with guava extract

Table 1 : Response of fruit flies to different colours and attractants used in traps (Interaction: Colour × Attractant).

Tr. no.	Treatments	Number of fruit flies/trap								
		1st week	2nd week	3rd week	4th week	5th week	6th week	7th week	8th week	9th week
1	White-Banana	0.00(0.71)^{h}	0.33(0.71)^{f}	0.33(0.88)^{g}	0.67(0.99)^{e}	0.33(0.88)^{g}	0.33(0.88)^{e}	0.33(0.88)^{e}	0.00(0.70)^{g}	0.33(0.88)^{e}
2	White-Guava	1.33(1.34)^{fg}	2.67(1.34)^{e}	2.00(1.58)^{f}	1.67(1.46)^{bcd}	1.67(1.46)^{ef}	2.00(1.55)^{d}	2.33(1.64)^{cd}	1.67(1.46)^{f}	2.67(1.76)^{cd}
3	White-Tulsi	2.00(1.56)^{defg}	3.67(1.44)^{de}	3.00(1.85)^{de}	2.67(1.77)^{b}	2.67(1.77)^{cdef}	2.67(1.77)^{cd}	3.00(1.85)^{bc}	2.67(1.77)^{def}	3.67(2.02)^{bcd}
4	Yellow-Banana	2.67(1.74)^{def}	3.67(1.56)^{cde}	3.00(1.87)^{de}	2.00(1.58)^{bcd}	3.33(1.89)^{bcde}	3.33(1.93)^{bcd}	3.33(1.93)^{bc}	3.33(1.93)^{cde}	3.67(2.02)^{bcd}
5	Yellow-Guava	4.67(2.24)^{abc}	4.67(1.93)^{bc}	5.00(2.34)^{ab}	2.33(1.67)^{bc}	4.67(2.26)^{b}	4.33(2.18)^{bc}	4.67(2.26)^{ab}	4.67(2.25)^{bc}	4.67(2.26)^{abc}
6	Yellow-Tulsi	6.00(2.53)^{a}	5.00(2.35)^{a}	5.67(2.48)^{a}	4.33(2.19)^{a}	7.33(2.78)^{a}	7.00(2.73)^{a}	7.00(2.73)^{a}	7.33(2.77)^{a}	5.00(2.33)^{ab}
7	Orange-Banana	1.67(1.46)^{efg}	3.00(1.46)^{de}	2.67(1.77)^{def}	1.33(1.34)^{d}	1.67(1.46)^{ef}	3.00(1.85)^{bcd}	2.33(1.67)^{cd}	2.33(1.64)^{ef}	3.00(1.85)^{bcd}
8	Orange-Guava	3.33(1.95)^{bcd}	4.67(1.77)^{cd}	3.33(1.95)^{cd}	2.67(1.77)^{b}	2.67(1.77)^{cdef}	4.67(2.27)^{b}	3.67(2.03)^{bc}	3.67(2.02)^{bcd}	4.67(2.26)^{abc}
9	Orange-Tulsi	5.00(2.35)^{ab}	6.67(2.20)^{ab}	4.33(2.19)^{bc}	4.67(2.27)^{a}	4.33(2.19)^{bc}	4.67(2.27)^{b}	4.67(2.27)^{ab}	5.33(2.38)^{b}	6.67(2.66)^{a}
10	Red-Banana	1.00(1.17)^{g}	2.33(1.22)^{e}	2.00(1.58)^{f}	1.67(1.44)^{bcd}	1.33(1.34)^{f}	2.33(1.64)^{d}	1.33(1.29)^{de}	1.67(1.46)^{f}	2.23(1.67)^{d}
11	Red-Guava	2.67(0.71)^{de}	4.00(1.55)^{cde}	2.33(1.67)^{ef}	2.00(1.58)^{bcd}	2.00(1.58)^{def}	3.00(1.85)^{bcd}	2.67(1.77)^{c}	3.33(1.93)^{cde}	4.00(2.11)^{abcd}
12	Red-Tulsi	3.00(0.71)^{cde}	5.00(1.77)^{cd}	4.33(2.18)^{bc}	4.00(2.11)^{a}	3.67(2.03)^{bcd}	4.33(2.19)^{bc}	3.33(1.95)^{bc}	4.67(2.24)^{bc}	5.00(2.33)^{ab}
S. Em (±)		0.14	0.13	0.08	0.11	0.15	0.15	0.16	0.12	0.19
C.D. @ 5%		0.41	0.39	0.25	0.32	0.46	0.44	0.48	0.38	0.57
C.V.		13.89	14.32	7.96	11.25	15.23	13.41	15.12	11.82	16.79

(4.67/trap) which were on par with each other. Less number of fruit flies were attracted to white trap with banana extract (0/trap), white trap with guava extract (1.67/trap) and red trap with banana extract (1.67/trap). During ninth week of sampling more fruit flies were attracted to orange trap with tulsi extract (6.67/trap), yellow trap with tulsi extract (5/trap) and red trap with tulsi extract (5/trap), which were on par with each other. Less number of fruit flies were attracted to white trap with banana extract (0.33/trap) (Table 1). Fruit flies were more attracted to tulsi extract and bright colour traps (yellow and orange). Fruit flies express strong sensitivity to short wave-length colours (ultraviolet to yellow) and limited sensitivity to long-wavelength colours (red) (Ravikumar and Virakthamath, 2007). It has been suggested, however, that attraction of certain frugivorous tephritids to colours, such as to yellow, may be associated with searching for adult food (Prokopy, 1977; Prokopy and Papaj, 2000).

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