

SEASONAL EFFICIENCY AND ECONOMICS OF TRAPS BAITED WITH PARAPHEROMONS AGAINST FRUIT FLIES, *BACTROCERA* SPP.



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Abstract:-Rakshak Fruit Fly Trap was found most effective to Bottle Fruit Fly Trap, trapped 35.18, 17.30 and 15.22 per cent more fruit flies during Kharif, Zaid and Rabi season, respectively. Methyl eugenol was most effective during Kharif and Zaid season but cue-lure was most effective during Rabi season. Maximum fruit flies were trapped during Zaid season. Bottle Fruit Fly Traps baited with methyl eugenol dispensed cotton wick and replenished at two month interval provide most economical and trapped 394.12 FFs on per rupee investment during Zaid season.

Keywords:Fruit Fly Traps, Lures, Dispensers, Efficiency and Economics.

INTRODUCTION:

Fruit flies are quarantine pest and are difficult to control. They have great impact on agriculture and cause enormous damage to fruits, vegetables and flower heads. Out of nearly 4,400 species of fruit flies distributed throughout the world (Norrbon, 2004), 250 species are of economic importance and are distributed widely in temperate and sub-tropical regions of the world (Christenson and Foote, 1960), but the greatest diversity of species occur in the tropical regions (Norrbon *et al.*, 1998). Habitats they occupy range from rainforest through to open grassland and suburbia (Michaux and White, 1999). More than 200 species of fruit flies have been reported from India, however, majority of them have no economic importance (Madhura and Verghese, 2003). The major economically important species of fruit flies are *Bactrocera cucurbitae*, *B. dorsalis*, *B. zonata* and *B. correcta*. Among these, *B. dorsalis*, *B. zonata* and *B. correcta* infest mango and guava and *B. cucurbitae* infests cucurbitaceous vegetables (Nath and Bhushan, 2006). Knowledge of seasonal abundance of the pest under the existing ecological conditions may be quite useful in mitigating the losses caused by these flies. Biotic factors viz., parasites, predators, host plant resistance and abiotic factors viz., temperature, rainfall, humidity and sunshine hours play an important role in regulation of the pest population. Parapheromones viz., methyl eugenol and cue-lure are good male attractants and play an important role both in monitoring and management of fruit flies. Keeping above point in view, present study has been conducted.

MATERIALS AND METHODS

The trial were conducted in RBD with 24 treatments (Table 1) and 3 replications at Main Experiment Station (MES) Vegetable Science, Horticulture and Students' Instructional Farm and in the Laboratory of Department of Entomology, N.D. University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad, U.P from 41st SW (Standard Week) 2008 to 22nd SW of 2010 during *Kharif*, *Rabi* and *Zaid* season. Mixtures of both para-pheromones (ME & CL) were prepared in the ratio of 6, 4, 1 of ethyl alcohol, methyl eugenol/cue-lure and malathion 50 EC. The fruit flies trapped in each trap were collected into plastic vials separately and brought to the laboratory, identified, counted and recorded at weekly interval. Further to fruit fly species and crop association, infested fruits of commonly grown having/ vegetables will be collected from Main Experiment Station (MES) Vegetable Science, Horticulture and other related place and brought to the laboratory, kept into insect rearing cages having a layer of fresh sand without any insect/pupae. The flies emerged will be preserved and identified. Unidentified specimens were preserved and sent for identification to Dr. C. A. Viraktamath, Principle Investigator, CAR Network Project on Insect Bio-systematic, Department of Entomology, G.K.V.K. Bangaluru.

RESULT AND DISCUSSION

Efficiency of traps baited with parapheromons for trapping of fruit flies

Data present in Table 2 revealed that the Bottle Fruit Fly Trap was most effective during *Kharif* season 2008-09 and maximum trapped 1592 Fruit Flies (FFs) when replenished at one month interval baited with methyl eugenol (ME) dispensed through ply wood (PW). The minimum fruit flies was trapped 126 FFs from same trap, chemical and replenished interval dispensed through cotton wick (CW). In case of cue-lure, maximum trapped 433 FFs dispensed through ply wood replenished at one month interval and minimum 150 FFs dispensed through CW replenished at three month interval. A total of maximum fruit flies trapped 1718 in ME baited traps replenished at one month interval.

Rakshak Fruit Fly Traps were recorded that most performed and maximum trapped 2446 FFs when replenished at three month interval baited with methyl eugenol (ME) dispensed through ply wood (PW) and minimum trapped 458 FFs in same lure replenished at two month interval. When trap baited with CL was maximum and minimum trapped 645 and 310 FFs replenished at one and three month interval, respectively. A total of maximum fruit flies were trapped (3383) in traps baited with ME replenished at one month interval and minimum 720 FFs were catch in trap baited with CL replenished at three month interval.

An overall observation during *Kharif* season, Bottle fruit fly trap was trapped of maximum fruit flies (2327) replenished at one month interval and Rakshak Fruit Fly Trap was trapped maximum fruit flies (4465) replenished at one month interval followed by two and three month intervals. Rakshak Fruit Fly Trap was most effective and trapped 10425 FFs i.e. $67.59 - 32.41 = 35.18\%$ more, followed by Bottle fruit fly trap.

Bottle fruit fly trap was trapped 1004, 623 and 459 FFs baited with CL through PW (Table 2), while 229, 107 and 204 FFs trapped in ME baited traps through PW from one, two and three month

replenished interval, respectively. In case of Rakshak Fruit Fly Trap, maximum fruit flies viz., 1235, 1345 and 1153 trapped baited with CL through PW, where 225, 224 and 226 FFs trapped baited with ME through CW from one, two and three month replenished interval, respectively. In case of total trapped flies, Bottle Fruit Fly Traps were trapped maximum flies (4429) in baited with CL followed by ME (879). Rakshak Fruit Fly Traps were trapped maximum flies (6202) in baited with CL followed by ME (1326).

An overall observation during Rabi season 2008-2009 and 2009-2010, Bottle Fruit Fly Traps were trapped 2048, 1577 and 1683 FFs, while in Rakshak Fruit Fly Traps were trapped 2405, 2663 and 2460 FFs from one, two and three month replenished intervals. Rakshak Fruit Fly Trap was most effective and trapped 7528 FFs i.e. $58.65 - 41.35 = 17.30\%$ more, followed by Bottle fruit fly trap.

Data present in Table 2 revealed that the Bottle Fruit Fly Trap baited with CL through CW was most effective and trapped 109, 218 and 124 FFs, when parapheromon replenished at one, two and three month intervals followed by PW. In case of ME, maximum flies trapped in PW viz., 22531, 25490 and 21180 FFs, when parapheromon replenished at one, two and three month intervals followed by CW. In case of Rakshak Fruit Fly Trap baited with CL through PW was most effective and trapped 178, 192 and 96 FFs, when lure replenished at one, two and three month intervals followed by CW. In case of ME, maximum flies trapped in CW viz., 32247, 27449 and 28746 FFs, when chemical replenished at one, two and three month intervals followed by CW. In case of total trapped flies in Bottle Fruit Fly Trap were maximum in ME followed by CL and it was 99.12, 98.46 and 98.70 per cent more from one, two and three month replenished intervals, respectively. In Rakshak Fruit Fly Trap were trapped maximum fruit flies in ME followed by CL and it was 98.72, 98.80 and 99.5 per cent more from one, two and three month replenished intervals, respectively.

On overall observation during Zaid season 2009 and 2010, Rakshak Fruit Fly Trap were trapped maximum flies followed by Bottle Fruit Fly Trap and it's were 8.18, 11.18 and 27.92 per cent more at one, two and three month intervals, respectively.

Rakshak Fruit Fly Trap was most effective and trapped 163420 (57.61%) FFs followed by Bottle Fruit Fly Trap 120228 (42.39%) FFs. Rakshak Fruit Fly Traps were trapped 15.22 per cent more fruit flies. Data in Table 4 revealed that the maximum fruit flies were trapped during *Zaid* season followed by *Kharif* and *Zaid* season. When parapheromon were replenished at one month interval, trapped 82.26 and 84.56 per cent more fruit flies flowed by *Kharif* and *Rabi* season. Where it was replenished at two month interval, trapped 90.29 and 89.37 per cent and at three month interval, trapped 84.95 and 86.22 per cent more fruit flies flowed by *Kharif* and *Rabi* season.

Performances of traps have been evaluated earlier also Sundar et al. (2012) reported that the Rakshak fruit fly trap was superior to bottle fruit fly trap. Maximum fruit flies were trapped when parapheromones were replenished at one month interval Patel and Patel, 1998; Jhala et al., 2008, Shukla et al., 2008 and Chua, 2009 but none of these workers have evaluated the performance of Bottle Fruit Fly Traps and Rakshak Fruit Fly Traps, hence present results could not be compared.

Economics of traps baited with parapheromons for trapping of fruit flies

Data given in Table 3 on economics of traps lures and dispensers revealed that, in case of CL during *Kharif* season, maximum of 1.78 fruit flies on per rupee investment were trapped in bottle fruit fly traps with lure dispensed through cotton wick and replenished at three months interval. It was followed by Rakshak fruit fly traps replenished at one, two and three months interval dispensed through cotton wick in which, respectively, 1.47, 1.59 and 1.59 FFs trapped on per rupee investment were found, where in ply wood, respectively trapped 0.83, 0.86 and 1.01 FFs on per rupee investment, Bottle fruit fly traps replenished at one, two and three months interval dispensed through ply wood in which, respectively, 0.65, 0.52 and 1.11 FFs trapped on per rupee investment and in cotton wick replenished at one and two months intervals were trapped 0.94 and 1.36 FFs. In case of ME, maximum of 10.23 fruit flies on one rupee investment were trapped in Rakshak fruit fly trap with lure dispensed through Ply wood and replenished at three months interval. It was followed by Bottle fruit fly trap (7.71 FFs/rupee) replenished at two months interval and (6.45 FFs/rupee) three months. Minimum (1.62 FFs/rupee) trapped in Bottle fruit fly trap replenished at one month intervals.

Data present in Table 3 revealed that CL dispensed through CW in Bottle fruit fly trap and replenished at three months interval and maximum of 7.90 FFs on one rupee investment were trapped during *Rabi* season 2008-2009 and 2009-2010. It was followed by CL dispensed through CW in Bottle fruit fly trap and replenished at two month interval, Rakshak fruit fly trap dispensed through CW and replenished at three and two months interval trapped, respectively 4.42, 3.98 and 3.22 fruit flies on per rupee investment. In case of ME, maximum of 2.71 fruit flies were trapped on one rupee investment in Rakshak fruit fly trap with lure dispensed through CW and replenished at two month interval. It was

followed by bottle fruit fly trap dispensed through CW and replenished at three months interval, Rakshak fruit fly trap dispensed through CW and replenished at three and two months interval. Minimum of 0.36 fruit flies were trapped on per rupee investment in Rakshak fruit fly trap dispensed through PW and replenished at one month interval.

Data given in Table 3 during *Zaid* season 2009 and 2010, in CL, maximum 1.84 fruit flies were trapped per rupee investment in Bottle fruit fly trap dispensed through CW and replenished at two month interval. Minimum 0.11 fruit flies were trapped per rupee investment in Bottle fruit fly trap dispensed through PW and replenished at one month interval.

In case of ME, maximum of 394.12 fruit flies on per rupee investment were trapped in Bottle fruit fly traps with lure dispensed through Cotton wick and replenished at two month interval. It was followed by Bottle fruit fly trap replenished at three and one month interval, Rakshak fruit fly trap replenished at three, one and two month interval, in which, respectively, 300.36, 242.49, 195.27, 171.22 and 170.58 FFs on one rupee investment were found. In case of PW, in Bottle fruit fly trap were trapped maximum of 165.09 FFs/rupee investments and replenished at three month interval. It was followed by Bottle fruit fly trap replenished at two months interval, Rakshak fruit fly trap replenished at three and two month interval, in which, respectively, 140.48, 119.24 and 100.3 FFs on per rupee investment were found.

Sundar *et al.* (2012) earlier reported that the Bottle Fruit Fly Traps dispensed through cotton wick and replenished at 3 months interval proved most economical (205.38 FFs/rupee). Rakshak Fruit Fly Trap baited with ME, maximum 38.25 & 31.09 FFs per rupee investment were trapped during June, 2011 & 2012, respectively.

Ply wood block (PW) dispenser was found more effective than cotton wick (CW). Similarly in case ME, ply wood block (PW) dispenser trapped 11.92% more fruit flies than cotton wick (CW). Ply wood block blocks have been found as better dispenser earlier also (Patel *et al.*, 2008; Singh *et al.*, 2008; Stonehouse *et al.*, 2008) hence confirm our findings. Rai *et al.* (2008) found non wood substrates superior however their replenished intervals were, respectively, after a week and after 45 days.

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Table 1: Details of treatments

Treatments	Details
T ₁	Bottle Fruit Fly Trap baited with ME soaked in cotton wick replenished at one month.
T ₂	Bottle Fruit Fly Trap baited with ME soaked in cotton wick replenished at two months.
T ₃	Bottle Fruit Fly Trap baited with ME soaked in cotton wick replenished at three months.
T ₄	Bottle Fruit Fly Trap baited with ME soaked in ply wood block replenished at one month.
T ₅	Bottle Fruit Fly Trap baited with ME soaked in ply wood block replenished at two months.
T ₆	Bottle Fruit Fly Trap baited with ME soaked in ply wood block replenished at three months.
T ₇	Bottle Fruit Fly Trap baited with CL soaked in cotton wick replenished at one month.
T ₈	Bottle Fruit Fly Trap baited with CL soaked in cotton wick replenished at two months.
T ₉	Bottle Fruit Fly Trap baited with CL soaked in cotton wick replenished at three months.
T ₁₀	Bottle Fruit Fly Trap baited with CL soaked in ply wood block replenished at one month.
T ₁₁	Bottle Fruit Fly Trap baited with CL soaked in ply wood block replenished at two months.
T ₁₂	Bottle Fruit Fly Trap baited with CL soaked in ply wood block replenished at three months.
T ₁₃	Rakshak Fruit Fly Trap baited with ME soaked in cotton wick replenished at one month.
T ₁₄	Rakshak Fruit Fly Trap baited with ME soaked in cotton wick replenished at two months.
T ₁₅	Rakshak Fruit Fly Trap baited with ME soaked in cotton wick replenished at three months.
T ₁₆	Rakshak Fruit Fly Trap baited with ME soaked in ply wood block replenished at one month.
T ₁₇	Rakshak Fruit Fly Trap baited with ME soaked in ply wood block replenished at two months.
T ₁₈	Rakshak Fruit Fly Trap baited with ME soaked in ply wood block replenished at three months.
T ₁₉	Rakshak Fruit Fly Trap baited with CL soaked in cotton wick replenished at one month.
T ₂₀	Rakshak Fruit Fly Trap baited with CL soaked in cotton wick replenished at two months.
T ₂₁	Rakshak Fruit Fly Trap baited with CL soaked in cotton wick replenished at three months.
T ₂₂	Rakshak Fruit Fly Trap baited with CL soaked in ply wood block replenished at one month.
T ₂₃	Rakshak Fruit Fly Trap baited with CL soaked in ply wood block replenished at two months.
T ₂₄	Rakshak Fruit Fly Trap baited with CL soaked in ply wood block replenished at three months.

Table 2: Efficiency of par pheromones baited traps against fruit fly, *Bactrocera* spp. during 2008-10

Replenishment interval	No. of fruit flies trapped														
	Bottle Fruit Fly Trapped							Rakshak Fruit Fly Trap							
	CL		ME		Total		Over All	CL		ME		Total		Over All	
	CW	PW	CW	PW	CL	ME		CW	PW	CW	PW	CL	ME		
Kharif season 2008 & 2009															
One month	176 (28.71)	433 (40.17)	126 (11.46)	1592 (39.78)	609 (26.17)	1718 (73.83)	2327 (34.26)	437 (71.29)	645 (59.83)	973 (88.54)	2410 (60.22)	1082 (24.23)	3383 (75.77)	4465 (65.74)	
Two month	161 (30.67)	218 (32.30)	387 (45.80)	409 (34.46)	379 (32.26)	796 (67.74)	1175 (36.36)	364 (69.33)	457 (67.70)	458 (54.20)	778 (65.54)	821 (39.91)	1236 (60.09)	2057 (63.64)	
Three month	150 (32.61)	329 (44.52)	235 (24.18)	782 (24.23)	479 (32.02)	1017 (67.98)	1496 (27.71)	310 (67.39)	410 (55.48)	737 (75.82)	2446 (75.77)	720 (18.45)	3183 (81.55)	3903 (72.29)	
Total	487 (30.48)	980 (39.33)	748 (25.65)	2783 (33.06)	1467 (29.35)	3531 (70.65)	4998 (32.41)	1111 (69.52)	1512 (60.67)	2168 (74.35)	5634 (66.94)	2623 (25.16)	7802 (74.84)	10425 (67.59)	
Rabi season 2008-2009 and 2009-2010															
One month	734 (50.90)	1004 (44.84)	81 (26.47)	229 (49.14)	1738 (84.86)	310 (15.14)	2048 (45.99)	708 (49.10)	1235 (55.16)	225 (73.53)	237 (50.86)	1943 (80.79)	462 (19.21)	2405 (54.01)	
Two month	674 (44.28)	623 (31.66)	173 (43.58)	107 (30.31)	1297 (82.24)	280 (17.76)	1577 (37.19)	848 (55.72)	1345 (68.34)	224 (56.42)	246 (69.69)	2193 (82.35)	470 (17.65)	2663 (62.81)	
Three month	935 (50.60)	459 (28.47)	85 (27.33)	204 (54.84)	1394 (82.83)	289 (17.17)	1683 (40.62)	913 (49.40)	1153 (71.53)	226 (72.67)	168 (45.16)	2066 (83.98)	394 (16.02)	2460 (59.38)	
Total	2343 (48.69)	2086 (35.85)	339 (33.43)	540 (45.34)	4429 (83.44)	879 (16.56)	5308 (41.35)	2469 (51.31)	3733 (64.15)	675 (66.57)	651 (54.66)	6202 (82.39)	1326 (17.61)	7528 (58.65)	
Zaid season 2009 and 2010															
One month	109 (44.86)	73 (29.08)	18815 (38.85)	22531 (57.92)	182 (0.44)	41346 (99.56)	41528 (45.91)	134 (55.14)	178 (70.92)	32247 (63.15)	16368 (42.08)	312 (0.64)	48615 (99.36)	48927 (54.09)	
Two month	218 (59.08)	133 (40.92)	19773 (41.87)	25490 (46.51)	351 (0.77)	45263 (99.23)	45614 (44.41)	151 (40.92)	192 (59.08)	27449 (58.13)	29310 (53.49)	343 (0.60)	56759 (99.40)	57102 (55.59)	
Three month	124 (72.51)	87 (47.54)	10951 (27.59)	21180 (42.63)	211 (0.65)	32131 (99.35)	32342 (36.04)	47 (27.49)	96 (52.46)	28746 (72.41)	28502 (57.37)	143 (0.25)	57248 (99.75)	57391 (63.96)	
Total	451 (57.60)	293 (38.60)	49539 (35.90)	69201 (48.26)	744 (0.62)	118740 (99.38)	120228 (42.39)	332 (42.40)	466 (61.40)	88442 (64.10)	74180 (51.74)	798 (0.49)	162622 (99.51)	163420 (57.61)	

Table 3: Economics of traps baited with parapheromones against fruit flies, *Bactrocera* spp. during 2008-10

Replenishment interval	Number of fruit flies trapped/rupee investment							
	CL				ME			
	CW		PW		CW		PW	
	Bottle trap	Rakshak trap	Bottle trap	Rakshak trap	Bottle trap	Rakshak trap	Bottle trap	Rakshak trap
<i>Kharif season 2008 & 2009</i>								
One month	0.94	1.47	0.65	0.83	1.62	5.17	5.53	6.05
Two month	1.36	1.59	0.52	0.86	7.71	2.85	2.25	2.66
Three month	1.78	1.59	1.11	1.01	6.45	5.01	6.10	10.23
<i>Rabi season 2008-2009 and 2009-2010</i>								
One month	2.05	1.51	0.78	0.88	0.55	0.88	0.41	0.36
Two month	4.42	3.22	1.14	2.05	2.71	1.28	0.46	0.71
Three month	7.90	3.98	1.09	2.17	1.69	1.40	1.12	0.57
<i>Zaid season 2009 and 2010</i>								
One month	0.58	0.45	0.11	0.23	242.49	171.22	78.30	41.074
Two month	1.84	0.66	0.32	0.36	394.12	170.58	140.48	100.31
Three month	1.47	0.24	0.29	0.24	300.36	195.27	165.09	119.24

Table 4: Seasonal performance of replenished interval during 2008 to 2010

Replenishment interval	No. of fruit flies trapped			Total
	<i>Kharif</i> season	<i>Rabi</i> season	<i>Zaid</i> season	
One month	6792 (6.68)	4453 (4.38)	90455 (88.94)	101700
Two month	3232 (2.93)	4240 (3.85)	102716 (93.22)	110188
Three month	5399 (5.44)	4143 (4.17)	89733 (90.39)	99275
Total	15423	12836	282904	3,11,063