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Effect of Time of the Day and Trap Height on the Catches of Peach/guava Fruit Flies, *Bactrocera zonata* (Saunders) Through Male Annihilation Technique

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Abstract: Field studies were conducted in guava orchard near NIA experimental farm, Tandojam to evaluate an efficient trap height and optimum time for trapping the fruit flies as an important component of pest management. To determine appropriate trap height, lure toxicant traps were hung at the height of 2, 4, 6, 8 and 10 feet from ground level and adult flies captured were counted weekly. Similarly, to note diurnal activity of flies, five traps were hung at 10 feet height at 5.00 h and data was recorded after each 2 upto 19.00 h. It was noted that significantly highest number of flies were captured in the traps hung at 10 feet height and maximum population was recorded during 5-7 h.

Key words: Guava, fruit fly, *Bactrocera zonata*, trap height, time of trapping

Introduction

Fruits are very much attractive for human beings. They offer a variety of delicious tastes and many of them like guava, mango, papaya, peaches etc. have great visual appeal. The consumers also like them for their nutritious value. Unfortunately, the fruit growing areas favour the activities of many insect pests. Tephritid fruit flies are among the major pests of fleshy fruits which effect its production throughout the world and represent the most economically important group of polyphagous Diptera (Robinson and Hooper, 1989). Fruit flies damage the guava and fleshy fruits of tropical and sub tropical regions which affect the quality of fruit for domestic consumption and export earning. Guava fruit is an important globally for its nutritious value and taste. Excellent salad and puddings are prepared from the shell of the ripe guava fruit. Guava jelly is well known to all and the common wild acid guava makes the best jelly. It can also be canned in sugar syrup or made into fruit butter (Rahman *et al*., 1990). The production of this fruit in Pakistan is lower as compared to other countries of the world. Besides other factors, the main case of its low production is heavy damage caused by fruit flies. According to a conservative estimates 25-50% damage has been recorded in guava fruit only due to this pest (Vargas, 1994; Syed *et al.,* 1970).

In Pakistan, guava has been grown on an area of 63.4 thousands hectare with a production of 525.5 thousand tones (Anonymous, 2000-2001). About 80% of guava fruits in markets were infested by fruit fly, *Dacus dorsalis*. High infestation of guava has resulted in abundant production of this popular fruit in Southern Pakistan and export of this fruit declined by about 50% in recent years. Besides direct losses, fruit fly infestation is a major trade barrier, resulting in economic losses to the growers (Kafi, 1986).

Due to concealed nature of damage by fruit fly, insecticidal spray is not much effective, whereas use of insecticides is being discouraged on the consumable products and due to pollution of the environment through toxic residues left in the atmosphere and on the fruits. The application of non-polluting, economical and effective methods are necessary to prevent losses in fruit production. From the beginning of 21st century, entomologists are concentrating on the use of autocidal control methods and male annihilation technique is one of them. This technique is an important component of fruit fly management programmes, which requires distribution of a large number of traps at a proper height. Certainly, trap height is helpful in reducing the number of flies per unit area. The initial work on the height of trap catches for fruit fly was carried out by Hart *et al*. (1967) and Holbrook and Fujimoto (1969). Later on work of Drew (1974), Hooper and Drew (1979), Haniotakis (1986), Tan (1984), Opp *et al*. (2000) and Papadopoulos *et al.* (2000) is worth mentioning. The guava fruit is attacked by a number of insect pests fruit flies, *Dacus* species are the most injurious and destructive pests, which have also been reported from Pakistan (Ghouri, 1960). Syed *et al.* (1970) have reported that guava fruit suffer 25-50% loss during summer, in some cases, the infestation was so serious that almost the entire crop was damaged.

Materials and Methods

The studies were carried out at 10 acres guava orchard in Kakwan (Dehli) Fruit Farm having orchard of various

fruits like mango, chikoo, ber etc. adjucent to NIA experimental farm, Tandojam. To determine appropriate trap height, the fruit fly traps baited with recommended dose of lure toxicant mixture were hung at the height of 2, 4, 6, 8 and 10 feet from the ground level. The experiment was replicated three times. These traps were suspended about 100 feet apart on the guava trees, but not obscured by tree foliage. Captured flies were collected at weekly intervals in polythene bags and brought to the laboratory for counting their population. The traps were cleaned perfectly to keep them in appropriate condition. The cotton wicks were replenished monthly and experiment was continued for one year.

In the second experiment, the observations were initiated to note the effect of time of day on the diurnal activity of male *B. zonata*. For this purpose five traps baited with lure toxicant mixture were suspended at a height 10 feet above the ground level once a week at 5 h in 24 acres mango orchard at NIA experimental farm, Tandojam. Observations for data recording were carried out after every 2 upto 19 h. Consequently, the experimental studies were continued for complete one year to know any change that could possibly be utilized for controlling programme. The results obtained were subjected to statistical analysis to obtain definite conclusions. Analysis of variance and means were separated by Duncan's multiple range test.

Results and Discussion

The analysis of variance revealed that the variations in the number of trapped flies were significantly different during the period under study (Table 1). The results on mean number of adults of *B. zonata* at different heights at 2, 4, 6, 8 and 10 feet from ground level indicated that significantly highest number of flies were captured in the traps, which were hung at 10 feet height, followed by 8 and 6, 2 and 4 feet (Table 1). Whereas, significantly higher number of adult flies were captured in the first week of June followed by first week of August and last week of June at 10 feet trap height. Therefore, it is inferred from the results that to control *B. zonata* through male annihilation technique, traps should be placed at a height of 10 feet above ground level. Furthermore, significantly higher number of adult flies were captured during the hotter than the cooler months. An important example of effect of trap height on the catches of different fruit flies is the study of Hooper and Drew (1979). They found that trap height is important and height of about 2 m was normal for orchard trapping but in rain forests the traps should be placed as high as 12.2 m within the forest canopy. Hart *et al.* (1967) placed traps at ground, 2 and 5 feet above ground to evaluate the effect of flies response and noted that traps were least attractive at ground level than at height level. Holbrook and Fujimoto (1969) designed the tests to determine the heights at which lure traps could attract the fruit flies. Their interpretation of the results was that traps placed 6 and 15 feet above the ground level captured significantly more number of Mediterranean fruit flies than trap placed at 0.1 - 2 feet. Koyama *et al.* (1982) and Papadopoulas *et al.* (2000) to detect the adults population in the experimental area, installed the baited traps at 1-1.5 m and 1.5-2 m, respectively, above the ground and obtained the satisfactory number of adults.

Similarly, Opp *et al.* (2000) during field studies in orchards, hung two traps per tree. One of the traps was hung high in the tree canopy (5 m from the ground), while the second trap was hung low in the canopy (2 m from the ground). Trap height in the canopy was shown to significantly affect the capture of flies in two localities, but was not significant in another locality. High traps captured greater numbers of both sexes of flies than low traps. However, high traps captured more number of flies than low traps early in the season, but after the first treatment, low traps captured more flies than high traps. In contrast, this study is not in line with Tan (1984), who placed the traps at 4 heights viz., 10-12, 5-7, 1.5-2 and 0.3-0.5 m above the ground level to find out the effect of trap height on catches of *Dacus* species and found that there was no significant effect on placing traps at various heights in relation to tree canopy. Haniotakis (1986) was also of the opinion that height has no effect on the catches of flies.

Results revealed that mean maximum number of flies (4.49) per trap per hour were captured during 5-7 h, followed by 2.12 and 1.29 during 7-9 and 9-11 h, respectively (Table 2). The mean minimum number of flies (0.64) per trap per hour were captured during noon i.e. 11-13 h. Thereafter, the fly population started building up and 0.76 and 0.80 flies were captured during 13-15 and 15-17 h, respectively. A second peak was recorded during 17-19 h in the evening, when a mean maximum number of 2.10 flies per trap per hour were captured. Therefore, it was observed that fruit flies exhibited a wide range of diurnal activities and the measures to control this pest should be adopted during the morning or in the evening hours.

Kazi (1976) noted that fruit flies were most active at 10-11 h, adult flies spent much of the day resting on other plants in the vicinity of cucurbit crops, largest population of adults was found on these plants before 8 h and after 17 h. Stegeman *et al.* (1979), while recording daily periodicity of male Tephritid, noted that the adult fruit flies were attracted to specific chemical lure earlier during the day time and peak attraction and population occurred

Table 1: Effect of height of trap on the catches of adults, *Bactrocera zonata* in different weeks

		Mean adult catches at different height of traps					
Weeks		2	4	6	8	10	Mean
Year, 1998							
April	1	112	174	117	136	129	133.69ij
	2	124	140	130	102	70	113.20ij
	3	420	470	314	315	259	355.60h-j
	4	883	1218	826	796	512	847.00h-j
May	1	1027	941	1474	995	776	1042.60h-j
	2	2009	1352	1178	1322	2046	1581.40h-j
	3	1030	1629	2135	2779	4296	2373.80g-j
	4	3225	3246	7069	6295	10124	5992.40de
June	1	5432	8480	15306	18478	22256	13990.40a
	2	4665	5602	8690	9611	10650	8034.60cd
	3	2443	2835	4827	7755	8185	5209.00ef
	4	4746	5882	7948	10515	19846	9787.40bc
July	1	5530	6736	7529	8373	7411	7115.80de
	2	5620	3130	6363	8639	17458	8242.00cd
	3	3352	4851	8773	5946	11556	4895.60e-g
	4	4914	4068	8107	12594	11584	8253.40cd
Aug.	1	7578	7081	10299	15787	14375	11024.00b
	2	5178	4120	7357	9852	8062	6913.80de
	3	3212	4032	6757	6981	7070	5610.40d-f
	4	3178	3498	6581	4544	6678	4895.80e-g
	5	8220	3327	4082	9716	11838	7436.60c-e
Sept.	1	2163	1285	2185	5197	4142	2994.80f-I
	2	1215	594	1075	1389	11089	1076.20h-j
	3	2998	2243	2754	3628	3980	3120.60f-h
Oct.	1	762	533	588	1249	788	784.00h-j
	2	360	364	345	613	754	487.20h-j
	3	306	357	585	341	289	375.60h-j
	4	315	474	555	355	287	397.20h-j
	5	367	357	244	385	693	409.20h-j
Nov.	1	158	193	201	286	705	308.60h-j
	2	166	179	212	290	687	306.80h-j
	3	151	191	201	303	692	307.60h-j
	4	172	186	211	271	710	310.00h-j
Dec.	1	115	108	164	408	510	261.00h-j
	2	30	58	74	111	120	78.60i
	3	600	466	49	14	50	235.80ij
	4	412	473	52	15	33	197.00ij
Year, 1999							
Jan.	1	320	312	30	13	25	140.00ij
	2	79	84	57	12	15	49.40j
	3	57	72	41	23	13	41.20j
	4	33	65	59	27	37	44.20j
Feb.	1	53	62	83	32	49	55.80j
	2	45	41	43	20	28	35.40j
	3	166	41	48	25	51	66.20j
	4	41	45	51	22	86	49.00j
Mar.	1	12	13	16	24	46	22.20j
	2	16	16	20	18	30	20.00j
	3	44	63	44	37	42	46.00j
	4	50	38	49	61	68	53.20j
	5	55	36	48	56	68	52.60j
		1683.18c	1635.28c	2518.96b	3135.12ab	3644.84a	

Table 2: Effect of time of day on the diurnal activity of peach fruit fly males, *Bactrocera zonata* (Saunders)

	Mean male fruit flies captured trap^{-1} h^{-1} at different time of the day						
Months	5-7	7-9	9-11	11-13	13-15	15-17	17-19
Year, 1999							
April	0.10	1.45	1.38	0.65	0.40	0.38	0.40
May	3.15	3.9	2.95	0.83	1.30	1.30	2.40
June	24.75	9.05	4.25	2.25	1.65	2.33	18.6
July	13.96	4.34	2.22	0.64	0.32	0.38	0.96
August	3.85	1.55	0.63	0.33	0.83	0.78	1.23
September	2.62	1.58	0.64	0.40	0.74	0.52	0.88
October	1.65	1.40	1.18	1.08	0.65	0.40	0.55
November	2.10	1.30	1.88	0.90	2.33	2.05	0.03
December	0.86	0.24	0.18	0.22	0.38	0.44	0.04
Year, 2000							
January	0.03	0.00	0.00	0.03	0.00	0.08	0.00
February	0.25	0.03	0.10	0.00	0.15	0.33	0.00
March	0.50	0.6	0.04	0.34	0.36	0.56	0.14
Total	53.82	25.44	15.45	7.67	9.11	9.55	25.23
Male flies captured per trap per hour.	4.49	2.12	1.29	0.64	0.76	0.80	2.10

earlier in the day during summer than in spring season. Thus, the findings of this study substantiated the results showed by these workers. The results interpreted during these series of studies conducted on the fruit flies would allow to the orchard growers to adapt this pest monitoring guidelines and to make control decisions. Furthermore, this study disseminate these guide lines in the environment friendly format that would furnish orchard growers with information that may be implemented timely into different regions. Control strategy, if planned on an orchard by orchard basis fashion, would lead to provide growers an undated management.

By considering the above detected results, it is suggested that pheromonal trapping is the safest, accurate and practical method of fruit fly control. In the areas, where trapping control technique is being used, traps should be placed at an optimum height of 10 feet from the ground surface and their population remains at peak during the hotter months than the cooler days of the year. Control strategy against fruit flies might be adapted during the morning or evening hours to attract and till sufficient number of flies in traps of treated areas, because during mid day time they remain concealed or disperse. It would be useful, if such treatments would be used on area-wide basis to suppress their population below a definite threshold level.

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