The Pharma Innovation Journal 2022; SP-11(8): 1785-1787

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(8): 1785-1787

www.thepharmajournal.com
Received: 21-06-2022
Accepted: 24-07-2022

Gaurav Bhagat
Division of Entomology, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, Chatha, UT of Jammu & Kashmir, India

Uma Shanka
Division of Entomology, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, Chatha, UT of Jammu & Kashmir, India

Amit Kumar Singh
Division of Entomology, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, Chatha, UT of Jammu & Kashmir, India

Yousra Mukhtar
Division of Entomology, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, Chatha, UT of Jammu & Kashmir, India

Corresponding Author
Gaurav Bhagat
Division of Entomology, Faculty of Agriculture, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, Chatha, UT of Jammu & Kashmir, India

Evaluation of male annihilation and bait attractant techniques for the management of fruit fly on mango

Gaurav Bhagat, Uma Shankar, Amit Kumar Singh and Yousra Mukhtar

Abstract
An experimental study was carried out at mango fruit orchards of SKUAST-J for two consecutive years (2019 and 2020) to evaluate the efficacy of Male Annihilation Technique (MAT) and Bait Attractant Technique (BAT) in managing the fruit fly population in mango. The results revealed that the population of fruit flies commenced from 9th to 32nd standard weeks in ME+Malathion and Banana+yeast+spinosad traps and 11th standard week in Fishmeal+diazinon trap during 2019. Two peaks of fruit fly populations were recorded in 24th standard week for ME+Malathion and Banana+yeast+spinosad and 29th standard week in Fishmeal+diazinon traps with second peak population in 32nd standard week for all the three treatments. During 2020, the fruit fly population commenced from 9th standard week in all the three traps. The fruit fly population peaked in 21st standard week with second peak in 28th standard week for all the three treatments. The fruit fly trap catches in all the three treatments were significantly different from each other.

Keywords: *Bactrocera* sp., mango, male annihilation technique, bait attractant technique, methyl eugenol

1. Introduction
Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae and is known as the king of fruits. The major constraint in the production of these important fruit crops is the ravages caused by insect pests more particularly by the fruit flies of the family Tephritidae. Fruit flies (Diptera: Tephritidae) are among the most economically important pests attacking mango fruits worldwide (White and Elson-Harris, 1994) [7]. According to an estimate the loss to mango in an unsprayed situation varied from 2.5 to 59.0% depending on the variety (Verghese *et al*., 2002) [6]. Pest control using large amounts of chemical pesticides is often mentioned as an important cause of residues on food stuff for the consumers. The integrated pest management (IPM) is a well-recognized technique and has recently been used for the management of fruit fly throughout the world. Fruit fly invasions can also be prevented by using the traps of various sizes around the perimeter of medium as well as large orchards which not only shows the promising results but also act as ecofriendly (Epsky *et al*., 2014) [2]. Without broadcasting of insecticide, toxic baits are considered as pest management means to diminish the fruit fly population (Navarro-Llopis *et al*., 2013) [4]. Chemical attractants such as methyl eugenol and cue lure are very useful for surveying, monitoring and controlling fruit flies. Keeping in view the importance of mango fruit crops, the present study was carried out to evaluate different techniques for the management of fruit fly on mango in Jammu sub-tropics.

2. Materials and Methods
An experiment was carried out at fruit orchards of SKUAST-J for two consecutive years (2019 and 2020) to evaluate the efficacy of Male Annihilation Technique (MAT) and Bait attractant Technique (BAT) in attracting the fruit fly species in mango. In Male Annihilation Technique (MAT), the different attractants like Cue lure, Protein hydrolysate, Methyl Eugenol (ME) were used for trapping of male fruit flies population on mango whereas, in Bait attractant Technique (BAT), Fish meal, Mashed banana, female biased technique with some food additives and oils were utilized for attracting the fruit flies for lure and kill method. All the MAT and BAT techniques were standardized in all mango orchards during both the years of study. Regular monitoring through the weekly collections of fruit flies in different treatments were made and data were collected to ascertain the efficacy of MAT and Bait techniques.

2.1 Observations and Statistical analysis

The weekly collected fruit fly populations in different types of MAT techniques were counted in all the three replications separately throughout the cropping season on mango and subjected to the transformation of the original weekly trap catches. As some weekly catches contained zero value, they were transformed by using the formulae Log (X+1), wherein, X denoted the original trap catches value. Further, the transformed values were analyzed statistically for the Tukey HSD test by using SPSS 20.0 IBM pack to draw valuable inferences.

3. Results and Discussion

Male Annihilation Technique (MAT) and Bait Application Technique (BAT) were followed to assess their efficacy in managing the population of fruit flies on mango during 2019 and 2020 and the data obtained has been presented in Table 1 and Table 2, respectively**.** Three bait trap combinations viz., Methyl eugenol (ME)+Malation, Banana+yeast+spinosad and Fishmeal+diazinon were evaluated for their efficacy against fruit flies on mango. The perusal of the obtained data revealed that during 2019, the population of fruit flies was noticed from 9th to 32nd standard weeks for ME+Malathion and Banana+yeast+spinosad traps. However, the fruit fly population was noticed from 11th standard week in Fishmeal+diazinon trap. The fruit fly population commenced from 9th standard week with mean number of 2.67 and 0.67 fruit flies per 3 trap catches in ME+Malathion and Banana+yeast+spinosad traps, respectively. Whereas, the mean number of 0.33 fruit flies per 3 trap catches commenced from 11th standard week in Fishmeal+diazinon trap. The fruit fly population then fluctuated, increasing and decreasing at various instances throughout the standard weeks and reached to its maximum in 24th standard week for ME+Malathion (1966.0 fruit flies per 3 trap catches) and Banana+yeast+spinosad (70.33 fruit flies per 3 trap catches). However, for Fishmeal+diazinon traps, the highest fruit fly population was noticed in 29th standard week with mean number of 11.67 fruit flies per 3 trap catches. From then onwards, the fruit fly population constantly decreased and again a relative upsurge in fruit fly population was noticed in 32nd standard week for all the three treatments wherein mean number of 458.67, 49.00 and 14.00 fruit flies were observed per 3 trap catches in ME+Malathion, Banana+yeast+spinosad and Fishmeal+diazinon traps. During 2020, the population of fruit flies commenced from 9th standard week with mean number of 4.67, 6.83 and 6.83 fruit flies per 3 trap catches in ME+Malathion, Banana+yeast+spinosad and Fishmeal+diazinon trap, respectively. The fruit fly population then fluctuated, increasing and decreasing at various instances throughout the standard weeks and reached to its maximum in 21st standard week for ME+Malathion (295.0 fruit flies per 3 trap catches), Banana+yeast+spinosad (158.0 fruit flies per 3 trap catches) and Fishmeal+diazinon traps (158.0 fruit flies per 3 trap catches). From then onwards, the fruit fly population constantly decreased and again a relative upsurge in fruit fly population was noticed from 26th standard week for all the three treatments causing a second peak of fruit flies in 28th standard week wherein mean number of 1678.67, 858.33 and 858.33 fruit flies were observed per 3 trap catches in ME+Malathion, Banana+yeast+spinosad and Fishmeal+diazinon traps, respectively. The results revealed that the fruit fly trap catches in all the three treatments were significantly different from each other. Our results are in coformation with the findings of Souder (2020) who found that a binary lure system may function as a generic MAT (ME + CL) against *B. dorsalis* and *B. cucurbitae* when populations of both species are associated in a cropping area. Ekesi *et al*. (2014) [1] after comparing the catches of *Bactrocera invadens* Drew, Tsuruta, & White (Diptera: Tephritidae) in Multi-lure traps baited with six commercial food-based attractants reported that Mazoferm E802 and Torula yeast were the most effective attractants and captured 2.4-2.6 times more females and 3.4-4.0 times more males than the standard Nulure. Lasa and Williams (2021) [3] recorded a positive correlation between the concentration of ammonia in solution (1.5–150 mM ammonium solution) and gaseous ammonia released by bottle-type traps which resulted in an asymptotic response in captures of *A. obliqua* flies in traps that released 99–295 µg ammonia/h.

Table 1: Evaluation of different MAT and BAT techniques for the management of fruit fly on mango during 2019

Treatments	Standard weeks												
	9	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
ME+ Malathione	2.67 (0.39)	4.00 (0.46)	9.33 (0.89)	2.67 (0.39)	0.33 (0.95)	10.33 (1.22)	17.67 (1.69)	50.00 (1.95)	89.33 (2.31)	206.67 (2.43)	271.33 (2.37)	232.67 (2.30)	201.33 (2.32)
Banana+ yeast+ spinosad	0.67 (0.0)	1.00 (0.0)	2.67 (0.39)	0.67 (0.0)	0.67 (0.20)	3.00 (0.69)	6.33 (1.14)	15.00 (1.45)	29.33 (1.62)	42.33 (1.68)	49.33 (1.70)	51.00 (1.70)	51.00 (1.73)
Fishmeal+ diazinon	0.00 (0.0)	0.00 (0.0)	0.33 (0.0)	0.67 (0.0)	0.33 (0.0)	0.67 (0.0)	1.67 (0.36)	3.33 (0.59)	5.33 (0.65)	5.67 (0.98)	10.67 (0.98)	10.67 (1.04)	12.00 (1.05)
F value	0.39h	0.46h	0.69g	0.39h	0.58gh	0.72g	1.06f	1.33e	1.53cde	1.70bc	1.68bc	1.68bc	1.68bc

Treatments	Standard weeks											
	22	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	
ME+ Malathione	209.33 (2.31)	204.33 (2.52)	332.67 (3.29)	1966.00 (2.59)	388.67 (2.73)	542.67 (2.72)	528.33 (2.69)	494.67 (2.56)	362.00 (2.46)	291.33 (2.66)	458.67 (0.39)	0.8126a
Banana+ yeast+ spinosad	54.67 (1.48)	31.67 (1.44)	28.67 (1.84)	70.33 (1.78)	61.67 (1.72)	54.00 (1.72)	53.33 (1.75)	57.67 (1.67)	48.33 (1.54)	35.67 (1.68)	49.00 (0.0)	1.4633b
Fishmeal+ diazinon	12.33 (0.56)	5.00 (0.59)	5.00 (0.85)	8.33 (0.74)	6.67 (0.85)	8.33 (1.09)	13.33 (1.03)	11.67 (0.90)	9.33 (1.01)	11.33 (1.11)	14.00 (0.0)	2.0573c
F value	1.70bc	1.45de	1.52cde	1.99a	1.70bc	1.77b	1.84ab	1.82ab	1.71bc	1.67bcd	1.82ab	
Treatment												3011.76
Week												214.49

Treatment*Week		7.40
P value		0.00

Note: Figures in parentheses are logarithmic "log(x+1),
Tukey HSD test, Treatments with the same letters are not significantly different (P<0.05).

Table 2: Evaluation of different MAT and BAT techniques for the management of fruit fly on Mango during 2020

Treatments	Standard weeks												
	9	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
ME+ Malathione	4.67 (0.75)	1.67 (0.43)	11.33 (1.09)	6.33 (0.87)	7.00 (0.90)	12.67 (1.14)	20.33 (1.33)	42.33 (1.64)	69.33 (1.85)	170.33 (2.23)	229.00 (2.36)	261.67 (2.42)	295.00 (2.47)
Banana+ yeast+ spinosad	6.83 (0.43)	5.83 (0.56)	11.17 (0.85)	9.17 (0.56)	10.00 (0.48)	13.33 (0.75)	17.67 (1.0)	29.17 (1.31)	43.17 (1.64)	94.17 (1.76)	124.00 (2.0)	140.83 (2.06)	158.00 (2.12)
Fishmeal+ diazinon	6.83 (0.37)	5.83 (0.60)	11.17 (0.73)	9.17 (0.37)	10.00 (0.43)	13.33 (0.52)	17.67 (0.78)	29.17 (0.88)	43.17 (1.11)	94.17 (1.53)	124.00 (1.65)	140.83 (1.88)	158.00 (1.95)
F value	0.46hi	0.44i	0.83fg	0.49hi	0.52ghi	0.77fgh	1.03ef	1.27de	1.53cd	1.84bc	2.00ab	2.12ab	2.18a

Treatments	Standard weeks											
	22	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	
ME+ Malathione	222.33 (2.35)	185.67 (2.27)	378.67 (2.58)	810.67 (2.91)	1346.67 (3.13)	1656.67 (3.22)	1678.67 (3.23)	656.67 (2.82)	235.33 (2.37)	134.67 (2.13)	174.67 (2.24)	2.02a
Banana+ yeast+ spinosad	122.17 (2.20)	104.33 (1.80)	201.33 (1.68)	417.83 (1.85)	686.33 (2.05)	841.83 (2.21)	853.33 (2.43)	342.83 (2.71)	132.67 (2.80)	82.83 (2.94)	103.33 (3.0)	1.70b
Fishmeal+ diazinon	122.17 (2.05)	104.33 (2.24)	201.33 (1.64)	417.83 (1.59)	686.33 (1.23)	841.83 (1.10)	853.33 (1.04)	342.83 (1.0)	132.67 (0.80)	82.83 (0.70)	103.33 (0.30)	1.07c
F value	2.20a	2.10ab	1.97ab	2.12ab	2.13ab	2.17a	2.22a	2.17a	1.98ab	1.91ab	1.83bc	
Treatment												497.11
Week												118.59
Treatment*Week												20.12
P value												0.00

Note: Figures in parentheses are logarithmic "log(x+1),
Tukey HSD test, Treatments with the same letters are not significantly different (P<0.05).

4. References

1. Ekesi S, Mohamed S, Tanga CM. Comparison of Food-Based Attractants for *Bactrocera invadens* (Diptera: Tephritidae) and Evaluation of Mazoferm–Spinosad Bait Spray for Field Suppression in Mango. Journal of Economic Entomology. 2014;107(1):299-309.
2. Epsky ND, Kendra PE, Schnell EQ. History and development of food-based attractants. In: Shelly T, Epsky N, Jang EB, Reyes-Flores J and Vargas R (Eds.), Trapping and the detection, control, and regulation of tephritid fruit flies. Springer, Germany, 2014, 75-118.
3. Lasa R, Williams T. Does Ammonia Released from Protein-Based Attractants Modulate the Capture of Anastrepha obliqua (Diptera: Tephritidae)? Insects. 2021;12:156.
4. Navarro-Llopis V, Primo J, Vacas S. Efficacy of attract-and-kill devices for the control of *Ceratitis capitata*. Pest Management Science. 2013;69:478-482.
5. Souder SK. Enhancing Male Annihilation Technique (MAT) of Fruit Flies (Diptera: Tephritidae) Using a Binary Lure System with a Biopesticide. Ph.D. Dissertation. University of Hawaii at Mānoa, College of Tropical Agriculture and Human Resources, Department of Plant and Environmental Protection Sciences, 2020, 150p.
6. Verghese A, Madhura HS, Jayanthi PDK, Stonehouse JM. Fruit flies of economic significance in India with special reference to *Bactrocera dorsalis* (Hendel). In: Sixth International Symposium on fruit flies of economic importance, Stellenbosch, South Africa, 6 to 10 May, 2002.
7. White I, Elson-Harris MM. Fruit Flies of Economic Significance: Their Identification and Bionomics. CAB International with ACIAR, 1994, 601p.