Pest Management in Horticultural Ecosystems
Vol. 30, No.2 pp 364-367 (2024)
DOI Number : 10.5958/0974-4541.2024.00060.8

RESEARCH NOTE

Eco friendly management of fruit fly, *Zeugodacus cucurbitae* infesting bottle gourd

KISHORE KUMAWAT[1*], M. M. KUMAWAT, N. L. DANGI, GAURANG CHHANGANI and ANITA YADAV

College of Agriculture, Agriculture University Jodhpur, 342304, Rajasthan, India

***E-mail**: kishorekum9587@gmail.com

ABSTRACT: Field trials were conducted to evaluate the efficacy of seven botanicals to manage melon fly, *Zeugodacus cucurbitae* (Coquillett) infesting bottle gourd. Out of seven botanicals azadirachtin (0.03%) was found most effective against fruit fly followed by NSKE. The maximum yield of bottle gourd (282 q ha^{-1}) was obtained from the plots treated with azadirachtin 0.03% followed by NSKE (280 q ha^{-1}) while the minimum fruit yield was obtained with *karanj* oil (268q ha^{-1}). The maximum incremental benefit-cost ratio was obtained from the plot treated with *tumba* crude extract (9.91) while the minimum benefit cost ratio (2.20) in *karanj* oil.

Keywords: Fruit fly, azadirachtin, NSKE, *karanj* oil, bottle gourd

Bottle gourd [*Lagenaria siceraria* (Molina) Standley], a white-flowering annual plant from the Cucurbitaceae family, is widely spread in tropical regions and plays an important role in local economies. It is grown during the spring, summer, and wet seasons. It is consumed as a vegetable. Bottle gourd is susceptible to the attack of several insect pests during different stages of crop growth like melon fly, *Zeugodacus cucurbitae* (Coquillett), red pumpkin beetle, *Raphidopalpa foveicollis* (Lues); hadda beetle, *Epilachna dermurili* Mulsent; whitefly, *Bemisia tabaci* Gennadius; aphid, *Aphis gossypii* Glover; leaf miner, *Liriomyza trifoli;* and mirid bug*, Nesidiocoris cruentatus* (Ballard). Among them, the melon fruit fly *cucurbitae* has been observed to cause serious damage to bottle gourd fruits. Maggots feed on pull inside the fruits. Losses to may reach 100 per cent if control measures are not applied (Vayssieres and Carel., 1999). In order to find safer means of managing fruit fly, the present study evaluated the efficacy of botanicals for the management of fruit fly infesting bottle gourd.

The present investigations were carried out at the Instructional Farm of the College of Agriculture, Jodhpur, Rajasthan, during the *kharif*, 2023. The experiment was conducted in a simple randomized block design with eight treatments including control and each replicated three times. The seeds of bottle gourd variety Pusa Naveen were sown on 12th August 2023 keeping row to row and at a spacing of 3 x 0.75 m2. The recommended package of practices was followed to raise the crop.

The spraying was done by using pre-calibrated knapsack sprayer. The first foliar spray of each treatment was commenced at the fruit setting stage on 16th October during 2023 when oviposition marks were noticed in bottle gourd fruits and the second spray was given on was given just after observing ETL. The quantity of water at the rate of 500 l/ha was used in each spray application. The observations on the total number of fruits and infested fruits in each plot were recorded regularly before and 4, 7, 10, 13, and 16 days after each spray application.The percentage of fruits infestation was worked out. The fruit yield per plot (kg) was recorded at three days interval and at the end of crop season of all the pickings per plot were cumulated and converted to hectares basis and then statistically analysed. To ascertain the cost-effective treatment. Incremental Cost Benefit Ratio (ICBR) was worked out by taking into account the expenditure on individual botanical treatment and the income from yield.

Effect of botanical treatments on fruit fly infestation

Four days after the first spray, all treatments significantly reduced fruit fly infestation compared to the control, with azadirachtin 0.03% showing the lowest infestation (14.47%) followed by NSKE (14.67%), which were comparable. Other effective treatments included moringa leaves and bark extract (20.20%), *Tumba* crude extract (20.83%), and castor oil (21.27%). Castor oil was at par with Thar Jaivik 41EC (25.37%), while

Karanj oil exhibited the highest infestation (27.43%). After seven days, azadirachtin 0.03% (12.87%) and NSKE (13.67%) remained the most effective, with no significant difference between them. Moringa leaves and bark extract (18.47%), *Tumba* crude extract (19.20%), and Castor oil (19.23%) were moderately effective, while Karanj oil (27.43%) remained the least effective. At 10 days, azadirachtin (14.17%) and NSKE (15.13%) continued to show the lowest infestation, followed by moringa leaves and bark extract (20.40%), *Tumba* crude extract (21.10%), and Castor oil (21.03%). At 13 days, azadirachtin (15.07%) and NSKE (15.63%) were again the most effective, with Moringa leaves and bark extract (21.30%), *Tumba* crude extract (22.27%), and castor oil (24.07%) showing moderate efficacy, and *Karanj* oil (30.83%) exhibiting the highest infestation. After 16 days, the infestation ranged from 15.90% (azadirachtin 0.03%) to 31.01% (karanj oil), with azadirachtin and NSKE continuing to show the lowest levels of infestation, followed by Moringa leaves and bark extract (22.57%), *Tumba* crude extract (23.10%), and Castor oil (24.77%), while *Karanj* oil (31.01%) remained the least effective. Overall, azadirachtin 0.03% and NSKE consistently performed the best, followed by Moringa leaves and bark extract, *Tumba* crude extract, and castor oil, with *Karanj* oil being the least effective treatment for managing fruit fly infestation.

Second spray

In the second spray application, all treatments significantly reduced fruit fly infestation compared to the control. Four days post-application, azadirachtin 0.03% exhibited the lowest infestation (13.87%), followed by NSKE (15.70%), both of which were comparable in effectiveness. The next most effective treatments included Moringa leaves and bark extract (20.73%), *Tumba* crude extract (21.43%), and castor oil (21.97%), with Castor oil being at par with Thar Jaivik 41EC (27.40%). *Karanj* oil showed the highest infestation (29.07%), indicating its lower efficacy. A similar pattern was observed seven, ten, and thirteen days after the second spray, with Azadirachtin 0.03% and NSKE consistently demonstrating the lowest infestation. Sixteen days post-application, Azadirachtin 0.03% (17.07%) and NSKE (18.57%) remained the most effective, followed by Moringa leaves and bark extract (25.83%), *Tumba* crude extract (26.70%), and castor oil (27.03%). Castor oil was also comparable to Thar Jaivik 41EC (28.40%), while *Karanj* oil continued to show the highest infestation (33.80%). Overall, azadirachtin 0.03% and NSKE were the most effective treatments in controlling fruit fly infestation, with *Karanj* oil proving to be the least effective.The order of effectiveness after sixteen days of application was azardiractin 0.03% > NSKE > moringa leaves and bark extract > *Tumba* crude extract > castor oil>thar jaivik 41EC > *Karanj* oil.

These observations are also supported by the findings of Khursheed and Desharaj (2012) who reported that spraying with azadirachtin was superior over malathion for controlling melon fruit fly with less per cent fruit damage. Sawai *et al*. (2014) reported that treatment of azadiractin was at par with DDVP and emamectin benzoate. Pal *et al.* (2015) reported that malathion 50EC @ 1ml/l provided maximum reduction in fruit infestation followed by NSKE. Ali *et al*. (2011) reported that minimum per cent fruit damage (41.94%) by fruit fly in bitter gourd was noticed in neem seed kernel extract treatment and was superior over other plant extract treatments.

Economics of the treatments

The maximum yield was recorded in the plot treated with azadiractin 0.03% with 282 q ha^{-1}followed by NSKE 280 q ha^{-1}fruit yield.The minimum fruit yield was obtained karanj oil (268q ha^{-1}) followed by Thar jaivik 41EC (270 q ha^{-1}).The maximum incremental benefit-cost ratio of 9.91 was recorded in tumba crude extract followed by 9.35 in azardiractin 0.03% and 7.57 in castor oil.The lowest benefit-cost ratio was computed in the plot treated with *karanj* oil (1:2.20) followed by moringa leaves and bark extract (4.33) (Table 2).

The study highlights the efficacy of various botanical insecticides in managing the fruit fly, *Z. cucurbitae*, in bottle gourd. Among the treatments evaluated, azadiractin at 0.03% emerged as the most effective in reducing fruit fly infestation, followed by NSKE and moringa leaves and bark extract. Economically, azadirachtin and NSKE proved to be highly cost-effective, showcasing favourable incremental cost-benefit ratios. These findings suggest that adopting botanical insecticides like azadirachtin and NSKE can be beneficial for sustainable pest management in bottle gourd production.

Table 1. Management of fruit fly infesting bottle gourd using botanicals pesticides (First spray)

Treatments	Dose	Per cent fruit infestation					
		Before spray	4 DAS	7 DAS	10 DAS	13 DAS	16 DAS
Azadirachtin 0.03%	5 ml/litre	20.07 (26.59)	14.47 (22.14)	12.87 (20.91)	14.17 (21.95)	15.07 (22.73)	15.90 (23.47)
NSKE	5 ml/litre	19.60 (26.23)	14.67 (22.52)	13.67 (21.63)	15.13 (22.79)	15.63 (23.25)	16.57 (23.90)
Moringa leaves & bark extract	10 ml/ litre	23.20 (28.74)	20.20 (26.66)	18.47 (25.44)	20.40 (26.70)	21.30 (27.42)	22.57 (28.30)
Tumba crude extract	5 ml/litre	22.27 (28.03)	20.83 (27.13)	19.20 (25.91)	21.10 (27.31)	22.27 (28.13)	23.10 (28.63)
Castor oil	2 ml/litre	23.93 (29.24)	21.27 (27.34)	19.23 (25.97)	21.03 (27.23)	24.07 (29.37)	24.77 (29.84)
Thar jaivik 41EC	4 ml/litre	27.87 (29.24)	25.37 (30.19)	25.17 (30.10)	27.10 (31.37)	30.47 (33.50)	30.60 (33.17)
Karanj oil	2 ml/litre	29.10 (32.64)	27.43 (31.57)	25.60 (30.38)	27.53 (31.62)	30.83 (33.70)	31.01 (33.44)
Untreated control		25.83 (30.54)	28.37 (32.18)	31.13 (33.90)	36.63 (37.24)	42.50 (40.67)	44.43 (41.79)
S.Em.±		1.34	1.34	1.23	1.32	1.34	1.35
C.D at (P= 0.05)		4.08	4.08	3.74	4.00	4.07	4.11

Figures in parenthesis are arcsine values
DAS: Days After Spraying

Table 2. Management of fruit fly infesting bottle gourd using botanicals pesticides (Second spray)

Treatments	Dose	Per cent fruit infestation						Mean yield (q ha^{-1})	Incremental Benefit cost ratio
		Before spray	4 DAS	7 DAS	10 DAS	13 DAS	16 DAS		
Azadirachtin 0.03%	5 ml/ litre	15.90 (23.47)	13.87 (2177)	13.50 (21.45)	14.63 (22.36)	16.23 (23.67)	17.07 (24.39)	281.7	9.35
NSKE	5 ml/ litre	16.57 (23.90)	15.70 (23.24)	14.97 (22.70)	16.23 (23.71)	16.87 (24.20)	18.57 (25.51)	280.0	5.67
Moringa leaves & bark extract	10 ml/ litre	22.57 (28.30)	20.73 (27.01)	19.07 (25.89)	21.57 (27.66)	22.43 (28.25)	25.83 (30.49)	278.0	7.57
Tumba crude extract	5 ml/ litre	23.10 (28.63)	21.43 (27.55)	19.77 (26.39)	22.50 (28.27)	23.77 (29.16)	26.70 (31.09)	274.7	2.20
Castor oil	2 ml/ litre	24.77 (29.84)	21.97 (27.92)	20.30 (26.72)	23.53 (29.02)	24.13 (29.36)	27.03 (31.25)	271.7	5.67

Thar jaivik 41EC	4 ml/ litre	29.93	27.40	25.40	26.17	27.43	28.40	262.0	9.91
		(33.17)	(31.56)	(30.24)	(30.75)	(31.55)	(32.17)		
Karanj oil	2 ml/ litre	20.37	29.07	26.73	29.50	31.07	33.80	267.3	4.33
		(33.44)	(32.60)	(31.09)	(32.88)	(33.87)	(35.54)		
Untreated control		44.43	47.87	44.53	42.20	40.83	35.56	259.7	
		(41.79)	(43.78)	(41.86)	(40.50)	(39.69)	(36.60)		
S.Em. ±		1.38	1.36	1.35	1.24	1.34	1.34	37.17	
C.D at (p= 0.05)		4.19	4.14	4.10	3.78	4.08	4.09	118.82	

Figures in parenthesis are arcsine values
DAS: Days After Spraying

ACKNOWLEDGEMENTS

The authors are grateful to the Dean, College of Agriculture, Jodhpur, for providing the necessary facilities.

REFERENCE

Ali, H., Ahmad, S., Hassan, G., Amin, A., Hussain, Z. and Naeem, M. 2011. Bioefficacy of different plant extracts against melon fruit fly in bitter gourd Pak. *Journal of Weed Science and Research,* **17**(2): 143-149.

Khursheed, S. and Raj, D. 2012. Bio-efficacy of certain insecticides and bio-pesticides against melon fruit flies, *Bactrocera* spp. *Pest Management in Horticultural Ecosystems*, **18** (2): 143-148.

Pal, S., Singh, D.K., Singh, U.R. and Vikram, A. 2015. Bio efficiency of neem formulations and organic chemicals for management of *Bactrocera cucurbitae* in bottle gourd. *Annals of Plant Protection Sciences*, **23**(1): 19-22.

Sawai, H. R., Godse, S. K., Narangalkar, A. L., Haldankar, P. M. and Sanas, A. P. 2014. Bio efficacy of some insecticides against fruit flies infesting ridge gourd. *Journal of Soils and Crops*, **24**(1): 174-180.

Vayssieres, J.F. and Carel, Y. 1999. Cucurbits infected by Dacini (Diptera: Tephritidae) in Reunion: A list of host-plants with stages of fruits susceptibility to stinging by females for cultivated species. *Annales de la Societe Entomologique de France,* **35**:197-202.

MS Received:14 September 2024
MS Acceptance: 25 October 2024