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Melon fruit fly infestation and management on ridge gourd in old alluvial zone of West Bengal

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Abstract
Seasonal trends in infestation level of *Bactrocera cucurbitae* were analyzed to determine the factors that influence the infestation by melon fruit fly in the field and adoption of suitable insecticidal management on ridge gourd were conducted during pre-*kharif* and *kharif* seasons in 2021 and 2022. Percentage of infestation was recorded on the basis of infested and total fruits. The highest fruit infestation *i.e.* 49.36% and 53.46% was recorded during 32nd (5th August) and 25th (23rd June) standard week during respective years. The correlation coefficient between per cent infestation by melon fly with weather parameters exhibited a significant positive correlation with maximum temperature in 2021 and minimum temperature in 2022. In case of management chlorphenapyr, acephate, spinosad and deltamethrin were most effective bio-rational insecticide for reducing fruit damage by melon fly and provided higher yield.

Keywords: Melon fruit fly, ridge gourd, abiotic factors, fruit infestation, insecticides

Introduction
Vegetables comprise a large number of plants mostly annuals, among these, the family Cucurbitaceous are being considered as most important. They cover a major share in area (159.16 thousand hectares) and production (1748.16 thousand tonnes) of total vegetables in the state (NHB, 2011) [13]. Ridge gourd is grown and harvested before maturity and eaten as a vegetable, popular in Asia and Africa. Its juice is used as a natural remedy for jaundice. In India, ridge gourd is common vegetables prepared with either crushed dried peanuts or with beans. In India, ridge gourd is cultivated in an area of 10,037 hectares with a production of 3,16,925 tons and 31.6 tons/hectare productivity (Anonymous, 2016) [4]. The cucurbits are subjected to damage by a wide array of insect-pests, major being, fruit fly (Sapkota *et al*., 2010; Banerjee *et al.*, 2011) [16, 5] right from the primordial stages of the crop to harvest of the products in India. The report on infestation of insect-pests attacking cucurbits in West Bengal is scanty. Jha *et al.* (2007) [10] observed the infestation of fruit fly to the tune of 17% on the crop in the district of Malda, Murshidabad and Malda. This pest is reported to cause up to 100% damage (Vignesh, 2015) [19]. Melon fruit fly damage young fruits, unopened flowers, and tender stems resulting in moderate to severe yield loss and complete crop failure under severe condition (Adhikari *et al.*, 2020) [3]. The fruits of cucurbits, of which the melon fruit fly is a serious pest, are picked up at short intervals for marketing and self-consumption. The farmers show little concern for the residual effect of chemicals, being more concerned about profit. The vegetables are brought to the market long before the chemicals have broken down. Haphazard and irrational use of chemical pesticides can lead to the risk of pest resurgence and the development of resistance against insecticide (Zhang *et al*., 2021) [21]. The use of chemical pesticides has been reported to effectively reduce fruit fly infestations (Abrol, Gupta, and Sharma 2019; Nehra *et al*., 2019) [2, 14] however, their frequent and haphazard use can lead to the development of resistance to most of these pesticides (Subedi *et al*., 2021) [18]. Therefore, it is necessary to have the basic knowledge about the approximate time and extent of damage by this fruit fly on ridge gourd and to explore the suitable insecticidal management as protective measure rather than curative since the maggots of fly damage the fruits internally due to its cryptic nature.

Materials and Methods

Infestation level study

The data were recorded at 7 days intervals at three locations (Gopalpur, Mirkamary and Faridpur) of Malda districts where no any pesticides were applied during the entire growing season on ridge gourd during 2021 and 2022. Only regular management tactics (cultural, prophylactic, etc.) were used in those experimental fields. Maximum and minimum temperatures, morning relative humidity (RH I) and evening relative humidity (RH II) and rainfall on monthly basis were recorded during the respective seasons of 2021 and 2022 from Meteorological department of Malda Krishi Vigyan Kendra, Ratua, Malda to determine correlation between the percentage of fruit infestation by female fruit fly and physical factors of environment. Based on the number of damaged and total fruits, the infestation level were recorded by observing different stages of the fruits *viz.* forming, small, medium and mature. The level of infestation was calculated by this formula:

$$\text{Damage percentage} = \frac{\text{Number of damaged fruits}}{\text{Number of total fruits}} \times 100$$

Insecticidal management

Healthy treated dry seeds of ridge gourd had been sown during first week of September in 2021 and first week of June in 2022 under normal practices with plot size of 4 m x 3 m and 15 cm height pit at the mid of plot after optimum land preparation in farmer's field at Gopalpur village, Malda. There were thirty six plots each with 2 plants. Vines were trained on trellises made of 1.52 m high fence wire. The recommended dose of fertilizers @ 50:25:25 (N: P: K) kg/ha were applied where nitrogen was given two equal splits *i.e.* one at the time of sowing and other at the time of the earthing up. Full dose of phosphate and potash were given at the time of sowing. Irrigation and weeding were done as and when required. The soil of the experimental site was sandy loam texture in medium land with good water holding capacity, drainage facility with moderate fertility status. The experimental area is situated under subtropical humid climate. As preventive as well as curative measures and at medium stage of fruit growth, attempts were made to evaluate the effect of eleven insecticides *viz* deltamethrin @ 10 g^{-ha}, flubendiamide @ 25 g^{-ha}, acephate @ 300 g^{-ha}, triazophos @ 200 g^{-ha}, cartap @ 250 g^{-ha}, neemazal @ 600 ml^{-ha}, karanja oil @ 1200 ml^{-ha}, citronella oil @ 1200 ml^{-ha}, spinosad @ 60 g^{-ha}, chlorfenapyr @ 50 g^{-ha} and emamectin benzoate @ 10 g^{-ha} with untreated control against melon fruit fly. The experiments were laid out in Randomized Block Design (RBD) with three replications for each treatment. Altogether twelve treatments comprising eleven insecticides along with an untreated check were evaluated. Spraying of insecticides was done by using air compression knapsack sprayer. Three consecutive sprays were given at 15 days intervals. Observations was done by direct counting the number of infested and total fruits per plot and were taken at one day before first spraying and 7 and 14 days after each spraying. Fruits were harvested by hand picking after every 7 days of treatment. The "Analysis of Variance" followed by critical difference (CD) at 5% level of significance was worked out from the data of melon fruit fly infestation at 7 and 14 days interval of each treatment and mean of the infestations were recorded and data was analyzed accordingly.

Results and Discussion

Melon fruit fly infestation on ridge gourd

The fruit infestation on ridge gourd was ranging from 25.44 to 49.36% and 19.46 to 53.46% respectively during 2021 and 2022. The infestation of melon fruit fly was recorded initially during 25th standard week (17th June) with 37.64 per cent fruit infestation and increased up to 44.44% with increasing temperature and decreasing relative humidity during 27th standard week (1st July). The fruit infestation attained the highest level (49.36%) during 32nd standard week (5th August) when maximum and minimum temperature, RH-I and RH-II and rainfall was 35.91°C, 26.23°C, 97.14%, 80.86% and 11.16 mm respectively as shown in Figure 1. During 2022, during 21st standard week (26th June), the initial infestation of 19.46 per cent was recorded and the infestation level was gradually increased from 22nd standard week (2nd June) and attained the highest (53.46%) during 25th standard week (23rd June) when maximum and minimum temperature, RH-I and RH-II and rainfall was 35.67°C, 26.91°C, 92.43%, 79.43% and 2.66 mm respectively, finally the infestation was 45.82 per cent at the time of harvesting (Figure 2).

Correlation between weather parameters and percentage of infestation by melon fruit fly

The data analyzed on correlation coefficient between per cent infestations by melon fly with weather parameters are presented in Table 1. The data showed that per cent infestation on ridge gourd by melon fruit fly exhibited a significant positive correlation (at 5% level) with maximum temperature (r=0.707) during 2021 and minimum temperature (r=0.707) during 2022, whereas other factors did not showed any significant impact on per cent of infestation. Its abundance increases when the temperatures fall below 32°C and the relative humidity ranges between 60 to 70% (Dhillon *et al*., 2005) [7]. Losses without control have been estimated as 12% of fruit and 21% of cucurbits in India (Mumford *et al*., 2005) [12]. Kumar *et al.*, (2006) [11] found maximum fruit fly infestation was 75.65% on ridge gourd. They stated that *B. cucurbitae* was significantly and positively correlated with relative humidity. Jakhar and Pareek (2005) [9] observed that among the cucurbits, ridge gourd was one of the most preferred hosts by the melon fruit fly. The incidence of melon fruit fly showed significant positive correlation with maximum and minimum temperature, whereas, afternoon relative humidity and rainfall had significant negative correlation with melon fruit fly incidence (Abhilash *et al*., 2017) [1].

Bio-efficacy studies

Effect of insecticides against melon fruit fly, (*B. cucurbitae*) infestation on ridge gourd

The per cent of fruit damage on ridge gourd by melon fruit fly was ranged from 28.77 to 33.84 per plant during 2021 before application of insecticides (Table 2). All the treatments had significant control of fruit fly from 7 days after first spray and onwards. Lowest mean per cent of fruit infestation per plant after seven days of first spray was found in acephate (7.61%) treated plot followed by chlorfenapyr (7.68%) and spinosad (9.06%) treated plot. But

after fourteen days, chlorfenapyr performed well in reducing fruit damage (13.13%) followed by spinosad (13.63%) and acephate (15.35%) and the lower performance was observed in karanja oil (29.33%) after seven days and citronella oil (29.32%) after fourteen days. In case of second spray, the lowest ridge gourd fruit infestation was observed in spinosad (7.76%) and deltamethrin (10.90%) treated plot after seven and fourteen days followed by chlorfenapyr (9.13%) and deltamethrin (10.69%) after seven days and chlorfenapyr (11.05%) and spinosad (11.60%) after fourteen days. Karanja oil (24.95%) and citronella oil (25.82%) showed the least performance after seven and fourteen days of second spray. After seven days of third spray, the best performance was showed in acephate treated plot (4.94%) and chlorfenapyr (11.08%) after fourteen days. Overall, chlorfenapyr (10.17%) provided to be most effective in reducing fruit damage followed by acephate (10.63%) and spinosad (10.92%). Karanja oil provided the highest fruit infested plots after three sprays. The highest per cent protection over control was recorded in chlorfenapyr (76.28%) followed by acephate (75.20%) and spinosad (74.53%) treated plot. During next year (2022), the infestation was varied from 26.42 to 31.98 per plant before application of insecticides (Table 3). Acephate and chlorfenapyr showed the best performance in lowering the fruit infestation by melon fruit fly in ridge gourd field after seven and fourteen days of first spray (6.17% and 11.38% respectively) followed by chlorfenapyr (8.97%) and emamectin benzoate (10.69%) after seven days and acephate (13.50%) and spinosad (15.59%) after fourteen days. The lowest mean per cent of fruit infestation per plant after seven days of second spray was noted in acephate (7.11%) treated plot followed by chlorfenapyr (7.54%) and spinosad (8.45%) but after fourteen days, spinosad showed the best performance (9.06%) followed by chlorfenapyr (9.54%) and acephate (11.64%). After third spray, chlorfenapyr was the best treatment in reducing the fruit damage after both seven and fourteen days (5.65% and 7.81% respectively). In case of overall mean per cent of reduction in fruit infestation, chlorfenapyr showed the best performance (8.48%) followed by acephate (9.20%) and spinosad (10.35%) and karanja oil was the least treatment in this regards. The highest per cent of protection over control was recorded in chlorfenapyr (81.68%) followed by acephate (80.13%) and spinosad (77.64%) treated plots.

Effect of insecticides on the productivity of ridge gourd

Highest yield of ridge gourd during 2021 and 2022 was observed in chlorfenapyr (10.08 and 13.50 ton/ha respectively) treated plot followed by acephate (9.74 and 10.16 ton/ha) and spinosad (9.12 and 9.69 ton/ha) (Table 2 and 3) respectively. The increased yield over control was highest in chlorfenapyr (7.57 and 11.46 ton/ha) during 2021 and 2022 respectively. In both the years, control plot showed the highest fruit infestation (42.87% and 46.29% respectively) and lowest yield (2.51 and 2.03 ton/ha respectively) as compared to other treatments. The efficacy of acephate was in conformity with Patnaik *et al.* (2002) [15]. Maximum fruit yield of 62.7 q/ha was recorded when acephate 75% SP was sprayed. After 3rd spray, the percentage of fruit damage reduction in nimbex was 2.00%, in acephate 2.53% and in emamectin benzoate 19.67% (Waseem *et al.*, 2009) [20]. Shinde *et al.* (2021) [17] reported that spinosad 45 SC was the most effective treatment which recorded minimum (19.38%) mean fruit infestation and was at par with Deltamethrin 2.8 EC (20.34%). Effective control of fruit flies is possible only by the periodic and controlled application of pesticides at regular intervals in the correct proportion. Insecticides such as spinosad provide effective protection against melon fruit flies followed by dichlorvos, lambda-cyhalothrin, Jholmal, and Azadirachtin on bottle gourd (Gautam *et al.*, 2021) [8]. Bhowmik *et al.* (2014) [6] also reported that melon fruit fly could be effectively controlled by spinosad (5.91%) followed by acephate and chlorfenapyr in pre-monsoon season and the best control was obtained by acephate (9.39%) followed by chlorfenapyr and spinosad during monsoon season on bitter gourd.

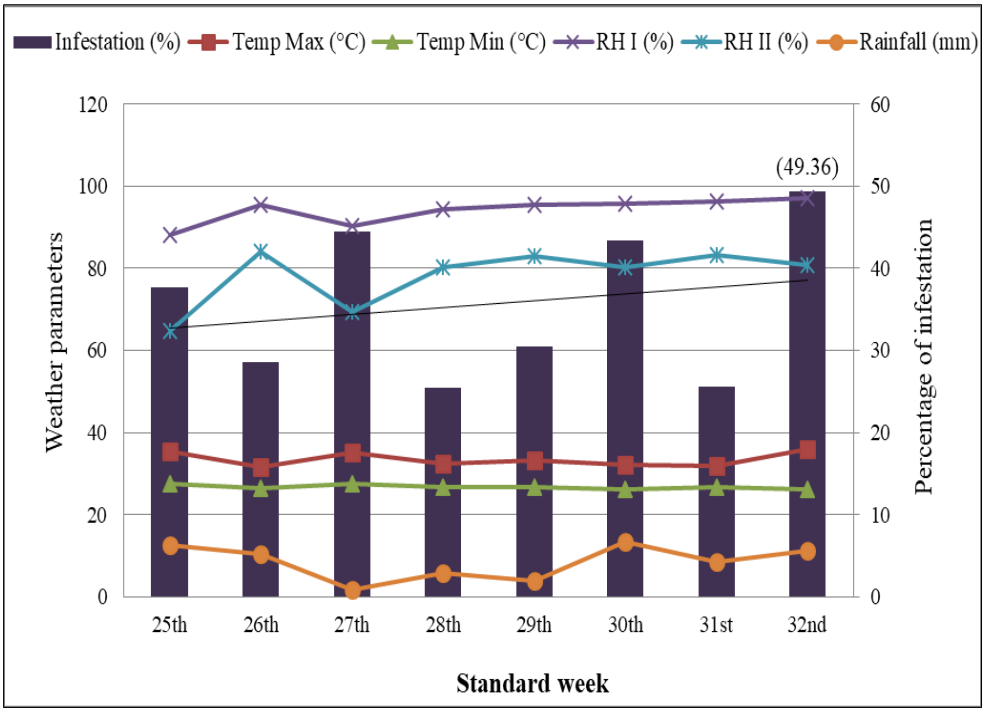

Fig 1: Correlation between weather parameters and percentage of infestation by melon fruit fly on ridge gourd during 2021

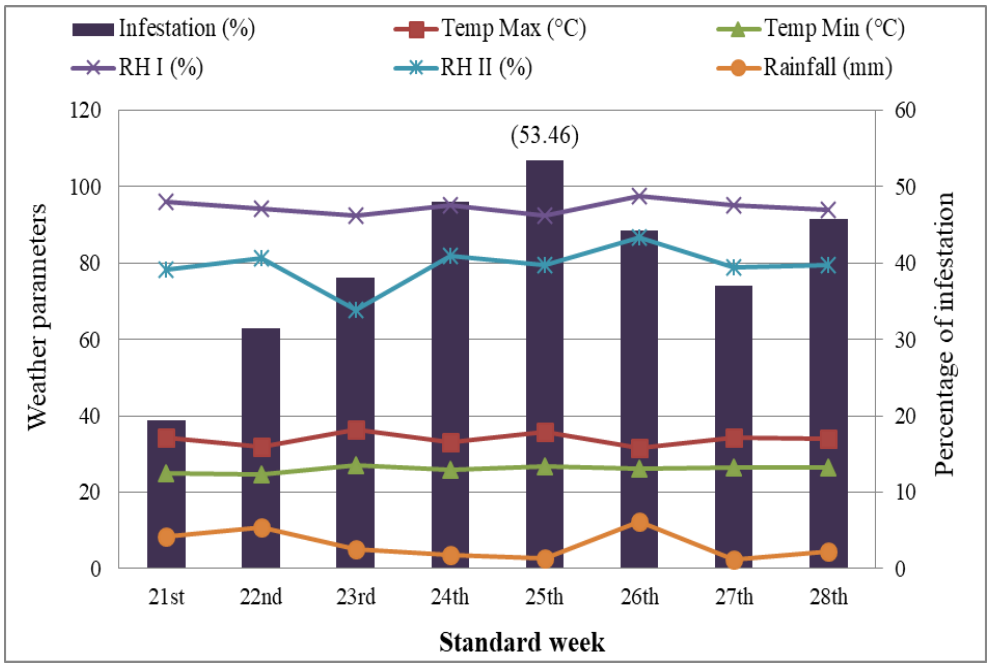

Fig 2: Correlation between weather parameters and percentage of infestation by melon fruit fly on ridge gourd during 2022

Table 1: Correlation between weather parameters and percentage of infestation by melon fruit fly on ridge gourd during 2021 and 2022

Weather parameters	Particulars	
	Melon fruit fly infestation during 2021	Melon fruit fly infestation during 2022
Max. Temperature (°C)	0.707*	0.088
Min. Temperature (°C)	0.005	0.707*
Relative humidity I (%)	-0.146	-0.305
Relative humidity II (%)	-0.406	0.211
Rain fall (mm)	0.227	-0.426

** Correlation is significant at the 0.01 level
* Correlation is significant at the 0.05 level

Table 2: Effect of different treatments against fruit fly infestation on ridge gourd during 2021

Treatments	Dose (g a.i./ha)	% fruit infestation (Before spray)	Fruit infestation after each spray (%)						Over all mean of fruit infestation	% protection over control	Yield ton/ha	Increased yield over control
			1st spray		2nd spray		3rd Spray					
			7 DAS*	14 DAS*	7 DAS*	14 DAS*	7 DAS*	14 DAS*				
Deltamethrin 2.8% EC	10	31.60	10.24 (18.66)	16.62 (24.06)	10.69 (19.08)	10.90 (19.28)	10.02 (18.45)	15.33 (23.05)	12.30	71.31	8.73	6.22
Flubendiamide 48% SC	25	33.43	18.68 (25.61)	23.58 (29.06)	12.25 (20.49)	18.10 (25.18)	11.79 (20.08)	15.77 (23.40)	16.70	61.05	7.87	5.36
Acephate 75% SP	300	30.59	7.61 (16.02)	15.35 (23.07)	11.50 (19.82)	12.29 (20.52)	4.94 (18.85)	12.07 (20.33)	10.63	75.20	9.74	7.23
Triazophos 40% EC	200	33.84	17.79 (24.94)	22.58 (28.37)	14.02 (21.99)	17.87 (25.00)	15.91 (23.51)	18.52 (25.49)	17.78	58.53	7.65	5.14
Cartap 50% SP	250	28.86	19.68 (26.33)	23.51 (29.00)	17.22 (24.52)	20.86 (27.18)	13.80 (21.81)	19.93 (26.52)	19.17	55.28	7.45	4.94
Neemazal** 10000 ppm	600 ml	32.14	24.87 (29.91)	27.23 (31.45)	20.32 (26.80)	21.32 (27.50)	18.02 (25.12)	21.22 (27.43)	22.16	48.31	5.90	3.39
Karanja oil**	1200 ml	32.72	29.33 (32.79)	28.46 (32.24)	24.95 (29.97)	25.11 (30.07)	21.16 (27.39)	22.41 (28.25)	25.24	41.12	4.68	2.17
Citronella oil**	1200 ml	29.54	26.58 (31.04)	29.32 (32.78)	23.60 (29.07)	25.82 (30.54)	20.06 (26.61)	22.88 (28.58)	24.71	42.36	5.29	2.78
Spinosad 45% SC	60	28.77	9.06 (17.52)	13.63 (21.66)	7.76 (16.17)	11.60 (19.91)	9.97 (18.41)	13.47 (21.54)	10.92	74.53	9.12	6.61
Chlorfenapyr 10% SC	50	33.31	7.68 (16.09)	13.13 (21.25)	9.13 (17.58)	11.05 (19.42)	8.92 (17.38)	11.08 (19.45)	10.17	76.28	10.08	7.57
Emamectin benzoate5% SG	10	29.94	14.11 (22.06)	17.76 (24.93)	21.38 (27.54)	19.21 (26.00)	10.15 (18.58)	14.59 (22.45)	16.20	62.21	8.13	5.62
Control	water	31.80	41.28 (39.98)	47.10 (43.34)	56.40 (48.68)	42.28 (40.56)	34.42 (35.92)	35.73 (36.71)	42.87	-	2.51	-
SEm ±, CD at 5% level		NS	1.02 3.14	0.95 2.95	2.73 8.41	1.14 3.51	0.91 2.82	0.97 3.01	-	-	-	-

DAS=Days after Spraying, * Significant at 5% level, ** Formulated product, Figures in parenthesis are arcsine transformed

Table 3: Effect of different treatments against fruit fly infestation on ridge gourd during 2022

Treatments	Dose (g a.i./ha)	% fruit infestation (Before spray)	Fruit infestation after each spray (%)						Over all mean of fruit infestation	% protection over control	Yield ton/ha	Increased yield over control
			1st spray		2nd spray		3rd Spray					
			7 DAS*	14 DAS*	7 DAS*	14 DAS*	7 DAS*	14 DAS*				
Deltamethrin 2.8% EC	10	27.61	14.56 (22.43)	17.17 (24.48)	10.69 (19.08)	15.78 (23.41)	8.16 (16.59)	9.48 (17.93)	12.64	72.69	9.05	7.01
Flubendiamide 48% SC	25	30.65	15.26 (23.00)	20.58 (26.98)	16.95 (24.31)	21.73 (27.79)	19.66 (26.32)	20.14 (26.66)	19.05	58.85	4.32	2.29
Acephate 75% SP	300	26.42	6.17 (14.38)	13.50 (21.56)	7.11 (15.47)	11.64 (19.94)	7.67 (16.07)	9.10 (17.56)	9.20	80.13	10.16	8.12
Triazophos 40% EC	200	30.34	12.39 (20.61)	18.16 (25.23)	12.43 (20.65)	14.96 (22.76)	11.38 (19.71)	14.81 (22.64)	14.02	69.71	7.22	5.19
Cartap 50% SP	250	29.92	12.81 (20.97)	22.06 (28.01)	17.22 (24.52)	17.31 (24.59)	11.95 (20.23)	15.96 (23.55)	16.22	64.96	7.01	4.98
Neemazal** 10000 ppm	600 ml	28.14	18.29 (25.32)	20.97 (27.26)	20.74 (27.09)	21.32 (27.50)	13.24 (21.34)	16.98 (24.34)	18.59	59.84	6.05	4.02
Karanja oil**	1200 ml	27.57	24.11 (29.41)	25.36 (30.24)	26.91 (31.25)	25.11 (30.07)	24.19 (29.46)	20.32 (26.80)	24.33	47.44	3.08	1.04
Citronella oil	1200 ml	29.46	18.46 (25.45)	27.36 (31.54)	23.60 (29.07)	28.85 (32.49)	16.01 (23.59)	25.26 (30.17)	23.26	49.75	3.15	1.12
Spinosad 45% SC	60	30.51	11.63 (19.94)	15.59 (23.26)	8.45 (16.90)	9.06 (17.52)	7.01 (15.35)	10.37 (18.79)	10.35	77.64	9.69	7.65
Chlorfenapyr 10% SC	50	31.64	8.97 (17.43)	11.38 (19.71)	7.54 (15.94)	9.54 (17.99)	5.65 (13.75)	7.81 (16.23)	8.48	81.68	13.50	11.46
Emamectin benzoate 5% SG	10	31.98	10.69 (19.08)	17.76 (24.93)	14.89 (22.70)	18.47 (25.45)	8.01 (16.44)	12.63 (20.81)	13.74	70.32	8.47	6.43
Control	water	26.71	39.63 (39.02)	47.10 (43.34)	53.33 (46.91)	45.95 (42.68)	47.00 (43.28)	44.72 (41.97)	46.29	-	2.03	-
SEm ± CD at 5% level		NS	1.03 3.16	1.01 3.11	1.48 4.57	1.40 4.31	1.27 3.92	1.19 3.68	-	-	-	-

DAS=Days after Spraying, * Significant at 5% level, ** Formulated product, Figures in parenthesis are arcsine transformed

Conclusion

Melon fruit fly, *Bactrocera cucurbitae* is widely distributed key insect pest throughout the World. Most of the major cucurbit vegetable crops are severely attacked by this single pest. As the cucurbit fruits are harvested at short intervals for marketing and self-consumption, it is difficult to rely on any insecticides as a means of controlling this pest due to its cryptic nature. Therefore, there is a basic need to initiate control measures with some new and safer chemicals through the knowledge of exact period and frequency of fruit infestation by this devastating menace.

References

1. Abhilash J, Naveen NE, Patil SU, Sharanabasappa, Mohankumar KS. Monitoring of melon fruit fly (*Bactrocera cucurbitae*), (Diptera: Tephritidae) in relation to weather parameters. J Entomol Zool Stud. 2017;5(5):1930-1935.
2. Abrol D, Gupta D, Sharma I. Evaluation of insecticides, biopesticides and clay for the management of fruit fly, *Bactrocera* spp. infesting bottle gourd. J Entomol Zool Stud. 2019;7(1):311-314.
3. Adhikari D, Joshi SL, Thapa RB, Pandit V, Sharma DR. Fruit fly management in Nepal: A case from plant clinic. J Biol Control. 2020;34(1):8-14. DOI: 10.18311/jbc/2020/22833.
4. Anonymous. Ridge gourd cultivation guide [Internet]. 2016. Available from: http://www.farmnest.com
5. Banerjee M, Jha S, Konar A. Bionomics of melon fruit fly, *Bactrocera cucurbitae* (Coquillett) on bitter gourd. *Geobios*. 2011;38(4):309-311.
6. Bhowmik P, Mandal D, Chatterjee ML. Chemical management of melon fruit fly, *Bactrocera cucurbitae* (Coquillett) (Diptera: Tephritidae) on bitter gourd (*Momordica charantia* L.). Pest Res J. 2014;26(1):68-73.
7. Dhillon MK, Singh R, Naresh JS, Sharma HC. The melon fruit fly, *Bactrocera cucurbitae*: A review of its biology and management. J Insect Sci. 2005;5(40):1-16.
8. Gautam M, Poudel S, Dhungana N, Bhusal N. Comparative efficacy of different insecticides against cucurbit fruit fly (*Bactrocera cucurbitae*) on bottle gourd (*Lagenaria siceraria*) in Sarlahi district, Nepal. Int J Nat Resour Ecol Manag. 2021;6(2):27-37. doi:10.11648/j.ijnrem.20210602.11.
9. Jakhar BL, Pareek BL. Preference of melon fruit fly, *Bactrocera cucurbitae* Coquillett to various cucurbits under semi-arid region of Rajasthan. Indian J Entomol. 2005;67(3):287-288.
10. Jha S, Khan MR, Sahoo S, Das S. Infestation of fruit fly (*Bactrocera cucurbitae*) on pointed gourd (*Trichosanthes dioica*). Sashya Surakhya. 2007;4(1):12-13.
11. Kumar KNK, Verghese A, Shivakumara B, Krishnamoorthy PN, Ranganath HR. Fruit flies of economic importance. In: Proceedings of the 7th International Symposium on Fruit Flies of Economic Importance, Salvador, Brazil; 2006 Sep 10-15, p. 249-253.
12. Mumford JD. Integrated management of fruit flies in India. Final technical report. RNRRS Crop Protection Project, Report No.: R8089; 2005, p. 183.
13. National Horticulture Board (NHB). Indian horticulture database. Government of India; 2011.
14. Nehra S, Singh S, Samota RG, Choudhary AL. Bioefficacy of newer insecticides and biopesticides against fruit fly, *Bactrocera cucurbitae* (Coquillett) on round gourd. J Entomol Zool Stud. 2019;7(4):97-101.
15. Patnaik HP, Sarangi PK, Mohapatra P. Studies on the incidence of fruit flies and jassid on summer bitter gourd and their control. Orissa J Hortic. 2002;32(2):87-90.

16. Sapkota R, Dahal KC, Thapa RB. Damage assessment and management of cucurbit fruit flies in spring-summer squash. J Entomol Nematol. 2010;2(1):7-12.
17. Shinde VM, Kabre GB, Aghav ST. Evaluation of insecticides and botanicals in the management of fruit flies infesting ridge gourd. Pharma Innov J. 2021;10(7):226-229.
18. Subedi K, Regmi R, Thapa RB, Tiwari S. Evaluation of net house and mulching effect on cucurbit fruit fly (*Bactrocera cucurbitae* Coquillett) on cucumber (*Cucumis sativus* L.). J Agric Food Res. 2021;3:100103. DOI: 10.1016/j.jafr.2021.100103.
19. Vignesh R. Population dynamics and management of melon fruit fly, *Bactrocera cucurbitae* (Coquillett) through eco-friendly techniques in cucumber [MSc thesis]. Dharwad: University of Agricultural Sciences; 2015.
20. Waseem MA, Nagangoud A, Patil BV, Prabhuraj A, Hussain A. Efficacy of some insecticides against melon fly, *Bactrocera cucurbitae* Coquillett on cucumber. Karnataka J Agric Sci. 2009;22(3):701-702.
21. Zhang DD, Xiao YT, Xu PJ, Yang XM, Wu QL, Wu KM. Insecticide resistance monitoring for the invasive populations of fall armyworm, *Spodoptera frugiperda*, in China. J Integr Agric. 2021;20(3):783-791. DOI: 10.1016/S2095-3119(20)63392-5.