A Study on Melon Fruit Incidence and Management

Bal Mukund Pandey

Asst. Professor, School of Agriculture, Graphic Era Hill University,

Dehradun Uttarakhand India

Abstract

The family Tephritidae (True fruit flies) is enormous, with over 4,200 species in 471 different genera. As a result, they are among the most numerous and harmful groups of insects in the genus Diptera. Produce like fruit and vegetables sometimes don't taste as well as they should, and Lefroy was the first to notice this. The insect is a serious problem for growers of bitter gourd, musk melon, snap gourd, snake gourd, and ridge gourd, among other cucurbitaceous crops. The bulk of India's more than 200 documented species of fruit fly are of little commercial value. This study looks at how common melons are and how to control them efficiently.

Keywords: *Melon Fruit, Management, Fruit Flies, Vegetables.*

Tob Regul Sci. ™ 2021;7(4): 582-599
DOI: https://doi.org/10.52783/trs.v7i4.1310

1. Introduction

Species of fruit flies from the genera Anastrepha, Bactrocera, Ceretistis, Dacus, Rhagolalis, and Texotrypana are a global agricultural problem. Bactrocera dorsalis, Bactrocerazonata, and Bactroceracorrecta are four of the most significant fruit fly species from an economic perspective. Most damaging to cucurbitaceous vegetables is Bactroceracucurbitae. Maggots are the culprits here. The female fruit fly lays its eggs on immature, fragile fruits and flowers. The female seals the oviposition hole with a sticky substance after depositing her eggs. [1]

The larvae bore holes in the fruit, allowing fungus and bacteria to enter and causing the fruit to decay. Fruits rot quickly because animals eat the pulp before they are fully ripe. When mature fruits are cracked open, a mound of maggots in the pulp may be seen, despite the fact that the symptoms are less visible. Attacks may also cause the second fruit to twist and bend. Adult flies have a black spot on the outer border of their wings and a reddish brown body with lemon yellow markings on the thorax. Maggots have no legs and seem like filthy white squirming creatures, thicker at one end and narrowing to a tip at the other.[2-3]

The pattern of cucurbit fruit fly infestations on individual cucurbits is crucial for effective pest control. The prevalence of melon fruit flies varies greatly from one area to another, and even from one kind of cucurbit to another. Consistent agricultural pest surveillance and monitoring is essential for establishing when to take action and what kind of control strategies are best. Depending on the cucurbit species and the growing season, pests may cause as much as a hundred percent yield loss. It is estimated that between 60 and 87 percent of pumpkin fruit on Soloman Island are infested by the pest. Some 31.27 percent of bitter gourd, 28.55 percent of water melons, and almost 50 percent of cucumbers are damaged or destroyed by fruit flies in India. Whether or not melon fruit flies are active in a given agro-ecosystem is highly dependent on the local climate and the variety of different hosts present in that area. To know whether to take action and what kind of pest control strategy is best, you need some background knowledge on the pest's frequency in connection to meteorological conditions. [4-6]

Insect behaviour often changes depending on the weather. Not only do members of a population communicate with others in close proximity to them, but they also engage in a wide range of interactions between themselves. The impact that these interactions have on the interacting individual or community determines whether they are good or negative. When the temperature drops below 32.2°C and the relative humidity is between 60 and 70%, the fly begins to reproduce aggressively. Certain shifts in fruit fly occurrence were traced back to variations in abiotic parameters, and they included the minimum and maximum temperatures, the amount of precipitation, and the humidity. [7-8]

Melon fruit fly populations fluctuated greatly owing to weather fluctuations, which greatly affected fruit infection. It was generally accepted that the degree to which fruit was infested by pests changed in response to changes in temperature, relative humidity, and other climatic factors. Several researchers have previously looked at the effect of meteorological conditions on fruit infection of various cucurbits caused by the melon fruit fly. Understanding the impact of weather conditions is crucial for effective control of cucurbit fruit fly in the tarai area.[9-10]

2. Material And Methods

The frequency and severity of damage caused by B. cucurbitae

The occurrence and amount of damage caused by the melon fruit fly on cucurbits in the eastern portion of Uttar Pradesh during the Zaid and Kharif seasons of 2021 were the focus of a comprehensive assessment. For this research, we focused on the district of Lucknow in the tarai area of eastern Uttar Pradesh. We chose five towns, each with two blocks known for their abundance of cucurbitaceous vegetables. Two farmers were chosen at random from each community. This meant that at least 20 farmer's fields throughout 10 villages were observed.Insecticides was strongly discouraged to be used by farmers. Cucurbits, such as bitter gourd, bottle gourd, ridge gourd, and cucumber, are cultivated extensively in this area of eastern Uttar Pradesh, which is part of the tarai region. Therefore, studies using these cucurbits were evaluated. Four months (March–June) of summer cucurbits and five months (July–November) of Kharif cucurbits were seen in the districts.

Research towards Keeping Tabs on the People

Especially for studying the ebb and flow of migratory insect populations, monitoring is a crucial tool. In the current research, a cue-lure trap was used to keep tabs on the cucurbit fruit fly population using either banana pulp bait or jaggery-based bait. The trial ran in the fields of local farmers in the Lucknow area in the 2019–20 and 2020–21 academic years. Over the course of two years, the behaviour of cucurbit fruit flies was tracked. The monitoring and investigations focused on three towns where vegetables were the main crop. There were three locations in each hamlet where each of the three attractants was applied. So, each attractan had a total of nine snares.

The effectiveness of pesticides in controlling Bactroceracucurbitae

A field experiment was carried out in a farmer's field in Sonughat, Lucknow (U.P.), between Zaid 2019 and 2020 to determine the effectiveness of several pesticides in the management of B. cucurbitae infestation in bitter guard. The "Arka Harit" bitter gourd variety was planted at a depth of 2.5 to 3.0 cm in pits dug immediately in the experimental plots. In both 2020 and 2021, planting took place in the last week of March. Seeds were steeped in water for 12 hours before being planted in the pits. The study was set up using a randomised block design and three independent replicates. Each treatment's plot was 4 metres by 3 metres. One metre was left between each row, and 60 centimetres was left between each plant. The seeds were planted in tiny holes spaced at regular intervals. Ten days after seeding, we picked out the sickliest and weakest seedlings and settled on a density of two or three plants per hole. Fertilisers were administered at the proper rates, and weeds were pulled by hand as needed. The remaining agronomic procedures necessary for harvest success were implemented.

Table1: Methods of controlling B. cucurbitae using insecticides

Treatment	Name of insecticide	Trade name	Conc. used(%)	Dose (g/ml/ l)	Cost of Insecicide Rs/l or kg	Source of availability
T1	Imidacloprid 17.8 SL	Gaucho	0.036	2.0	1250 = 00	Bayer corporation
T2	Spinosad 45 SC	Conserve	0.015	0.33	9000 = 00	Dow Agro sciences
3	Cypermethrin 10 EC	Suraksha	0.005	0.50	450 =00	Nagarjuna Fertilizer and chemical .Limited
	Carbaryl 50	Sevin +	0.10 +5.0		450=00 +	Aventis crop science

T4	WP+Jaggery	Gur		2.0+50	20 = 00	and Limited
T5	Malathion 50 EC	iddle	0.05	1.0	400 = 00	Kalyani Industries Limited
T6	Carbaryl 50 WP	Sevin	0.1	2.0	450 = 00	Aventis crop scienceand Limited
T7	NSKE	---	5.0	50.0	10 = 00	Self prepared
T8	Neem Oil	---	5.0	5.0	100 = 00	Locally available
9	Control Untreated check)	---	---	---	---	---

Observations:

The results of the study document the impact of pesticides on cucurbit fruit fly infestation. All fruits of marketable size were collected from each treatment after each spraying, regardless of whether they were healthy or damaged. During each harvest, both healthy and diseased fruit were separated, numbered, and documented according to their infestation status:

$$\text{Per cent fruit infestation} = \frac{\text{No. of infested fruits}}{\text{Total no. of fruits}} \times 100$$

The total percentage of infested fruit at each harvest for each treatment was calculated. We weighed and statistically analysed the number of healthy, marketable fruits produced by each treatment after each spray. After angular transformation, the data were then analysed using ANOVA to see how the treatments affected the percentage of damage caused by fruit flies.

The economics were calculated under the following headings by converting the yield of marketable fruits from nett plot area to a hectare basis and applying the appropriate formulae:

1. The overall treatment cost =Costofinsecticide+Labourcharge+Sprayerrent
2. Total earnings =Salepriceofproduct XTotal yield
3. Additionalincome(Rs./ha)=Valueofyieldsavedbyinsecticide– Cost ofcontrol

$$\text{Cost of benefit ratio (Rs./per rupee invested)} = \frac{\text{Value of yield saved by insecticide.}}{\text{Cost of control}}$$

3. Results

Table show that in the district of Lucknow, cucurbits suffered the most damage from Bactroceracucurbitae during the Kharif season, whereas the Zaid crops suffered less. The highest percentage of infection occurred in June for the Zaid crop, and in August for the Kharif crop. Damage to the Zaid crop ranged from 17.65% (bitter gourd) to 26.37%% (cucumber). Maximum infestation was recorded in bitter gourd (38.37%), next in cucumber (32.93%), then in bottle guard (31.19%), and finally in ridge gourd (25.68%) during the Kharif crop. In both Zaid (2021.87%) and Kharif (27.37%), ridge gourd fruit suffered the least amount of damage. Evidence suggests that cucurbit fruit fly infected all of the investigated cucurbits. This statistic reflects the prevalence of Bactroceracucurbitae in the Eastern U.P. Kharif cucumbers had a significantly worse pest problem than Zaid cucumbers had because of the season difference.

Table 2: Bactroceracucurbitae's Zaid, 2019 district infestation severity in various cucurbits:

Month	No. of harvest	Bottlegourd	Bittergourd	Ridgegourd	Cucumber	Averageinfestation
March	4	15.65	8.75	5.65	28.75	**14.70**
April	4	18.19	15.44	7.25	10.15	**12.75**
May	4	25.75	20.75	15.78	35.75	**24.50**
June	4	39.70	25.60	44.50	30.85	**35.2021**
Average		**24.82**	**17.63**	**18.29**	**26.37**	21.77

Table 3: Bactroceracucurbitae infestation in several cucurbits in the Kharif, 2019 zone:

Month	No. of harvest	Bottle gourd	Bitter gourd	Ridge gourd	Cucumber	Av. Infesta-tion
July	4	35.72	52.60	10.00	30.37	32.17
August	3	31.82	40.75	38.80	28.75	35.03
September	3	28.00	32.35	28.75	37.80	31.72
October	4	34.30	30.47	17.00	32.75	28.63

November	4	26.15	35.71	33.85	35.00	32.67
Average		31.19	38.37	25.68	32.93	32.04

Connection to Zaid's squashes and cucumbers:

Research on the prevalence of pests in various cucurbits was conducted in March, April, May, and June of Zaid, 2019. It is clear from the data in table that the highest temperature in bottle gourd had a non-significant positive association with the amount of infestation, whereas the lowest temperature exhibited a significant positive correlation with relative humidity (Av.) and rainfall. Maximum and lowest temperatures as well as rainfall significantly correlated positively with infection levels in bitter gourd, whereas the average relative humidity lacked statistical significance. Extent of infection in ridge gourd was shown to have a statistically significant positive link with minimum temperature, average relative humidity, and rainfall. Average relative humidity was positively correlated with cucumber damage, although minimum temperature and rainfall were not. There was no statistically significant negative association between maximum temperature and the prevalence of cucumber infestations. Total infested area owing to Bactroceracucurbitae in cucurbits under was positively influenced by minimum temperature, average relative humidity, and rainfall.

Table 4: Damage to several cucurbits in Zaid's, 2019 and its correlation to meteorological factors:

S. No	Meteorological Variables	Cucurbits			
		Bottle gourd	Bitter gourd	Ridge gourd	Cucumber
1	Max. Temperature (°C)	0.47	0.75*	0.35	-0.17
2	Min. Temperature (°C)	0.91*	0.99*	0.84*	0.32
3	Av. Relative Humidity (%)	0.68*	0.37	0.76*	0.59*
4	Rainfall (mm)	0.91*	0.73*	0.96*	0.27

Relation to Kharif pumpkins and cucumbers:

Infestation levels in several cucurbits were tracked during the months of July, August, September, October, and November of Kharif 2019. The highest and lowest temperatures and average relative humidity all have a role in determining the severity of damage to a bottle guard, as shown in Table for Location I, District Lucknow. However, there was only a weak negative connection (r = -0.05) between rainfall and the level of infection in bottle gourd. There was a positive association between high and low temperatures and the severity of bitter guard damage (r = 0.48). There was a positive correlation between average relative humidity and rainfall and fruit damage percent in bitter guard, but the relationship was not statistically significant. Maximum temperature, lowest temperature, and relative humidity were shown to have a non-significant negative connection with the percentage of infested fruit along the ridge guard (r = -0.36, -0.27, and -0.13, respectively). Although there was a positive association between rainfall and temperature (r = 0.28), it was not statistically significant. Maximum (r = -0.31) and lowest (r = -0.39) temperatures and average relative humidity (r = -0.33) showed a non-significant negative connection with data on cucumber fruit infections owing to B. cucurbitae. Nonetheless, there was a non-significant positive connection between rainfall and cucumber fruit damage (r = 0.01).

Table5: Damage to several cucurbits in Kharif, 2019 and its correlation to meteorological factors:

S. No.	Meteorological Variables	Cucurbits			
		Bottle gourd	Bitter gourd	Ridge gourd	Cucumber
1	Max. Temperature (°C)	0.59*	0.48*	-0.36	-0.31
2	Min. Temperature (°C)	0.59*	0.48*	-0.27	-0.39
3	Av. Relative Humidity (%)	0.51*	0.28	-0.13	-0.33
4	Rainfall (mm)	-0.05	0.18	0.28	0.01

Investigations into Methods of People-Tracking

These are not circumstances conducive to the spread of disease in cucumber fruit. Neither location's Kharif season weather had a uniform effect on the prevalence of ridge gourd fruit pests.

Seasonal adjustments made by a melon fruit fly

For two years, monthly adult B. cucurbitae population counts were performed. Table demonstrates that in 2019 and 2020-21, the trap began attracting cucurbit fruit flies on the very first day it was deployed. Over time and in reaction to shifting lures, fly populations have fluctuated. Traps baited with cue-lures were the most successful in capturing adult B. cucurbitae, followed by traps baited with banana pulp and jaggery. The average number of melon fruit flies collected using cue lure increased from 4.64 in 2020–202021 to 8.01 after the first installation in February. There were a record 30.22 flies caught in July and August of 2019-2020, and a record 32.31 flies caught in July and August of 2020-2021. Thereafter, the population gradually declined until reaching its lowest point in January of both years. (1.3 and 1.63) for every trap separately. As shown in Table, the number of male adults caught in cue-lure traps rose from

14.96 in 2019-2020 to 2021.34 the following year.

Table 5 B: cucurbitae captures from various trapping agents in 2019-20 and 2020-2021

Month	Meannumberoffliescaught/trap/day						Mean
	Cue-lure		Jaggerybait		Bananabait		
	2019-20	**2020-21**	**2019-20**	**2020-21**	**2019-20**	**2020-21**	
Feburary	8.01	4.64	3.20	2.83	3.07	2.21	**3.99**
March	14.37	13.53	3.69	6.45	5.87	5.43	**8.22**
April	11.53	2021.65	6.71	7.53	7.39	7.95	**9.62**
May	12.23	14.80	7.86	8.96	7.51	8.62	**9.99**
June	18.60	17.65	7.42	11.54	6.94	11.33	**12.24**
July	30.22	32.31	13.30	15.72	14.21	14.47	**20.03**
August	32.56	33.06	2021.10	14.95	13.50	13.93	**20.68**
September	23.25	26.39	9.18	10.97	12.04	11.75	**15.59**
October	2021.45	19.94	4.21	6.63	5.84	8.19	**10.21**
November	7.80	10.60	1.72	3.24	2.71	3.79	**4.97**
December	3.30	4.93	1.03	1.64	1.44	2.79	**2.52**
January	1.30	1.63	1.41	1.27	0.84	1.60	**1.33**
Mean	**14.96**	**6.34**	**6.36**	**7.64**	**6.77**	**7.66**	-

Impact of Climate Variables on Trap Catching:

Weather characteristics including maximum and lowest temperatures, average relative humidity, and rainfall were studied in connection to B. cucurbitae trap captures. Catch per trap in cue lure bottle traps correlated positively with maximum temperature (r = 0.567), lowest temperature (r = 0.819), average relative humidity (r = 0.266), and rainfall (r = 0.466), although this relationship was not statistically significant in 2019-20. Banana pulp bait showed the same pattern. The highest temperature (r = 0.613), the minimum temperature (r = 0.822), the average relative humidity (r = 0.138), and the rainfall (r = 0.393) were all positively correlated with the adult fly captures in banana pulp bait, but the correlations were not statistically significant.

Table 6: Ratio of captured flies exposed to various attractants and weather conditions. 2019-20:

Meteorologicalfactors.	Cue-lure bottletrap	Banana pulpbait	Jaggery basedbait
Max.Temperature(°C)	0.567	0.613	0.572
Min.Temperature(°C)	0.819	0.822	0.756
Av.Relative Humidity(%)	0.266	0.138	0.099
Rainfall(mm)	0.466	0.393	0.436

Table7: The correlation coefficient for fruit flies captured using a variety of attractants and environmental conditions 2020-21.

Meteorologicalfactors.	Cuelurebot-tletrap	Bananapulpbait	Jaggerybasedbait
Max.Temperature(°C)	0.691	0.709	0.674
Min.Temperature(°C)	0.852	0.888	0.892
Av.Relative Humidity(%)	0.148	0.089	0.090
Rainfall(mm)	0.352	0.437	0.411

Table8: Coefficient of similarity for fruit flies caught with different baits and settings. combined (2018-2019 and 2020-21).

Meteorologicalfactors.	Cue lure bottletrap	Bananapulpbait	Jaggery basedbait
Max.Temperature(°C)	0.632*	0.663*	0.625*
Min.Temperature(°C)	0.836*	0.858*	0.836*
Av.Relative Humidity(%)	0.206	0.112	0.093

Rainfall(mm)	0.409*	0.414*	0.420*

Jaggery-based bait showed a correlation pattern similar to the other types of bait. The maximum temperature (r = 0.572), lowest temperature (r = 0.756), average relative humidity (r = 0.099), and rainfall (r = 0.436) were positively but insignificantly correlated with the number of adult flies caught in traps using jaggery-based bait. During 2020–2021, a non-significant positive correlation was found between maximum temperature (r = 0.691), minimum temperature (r = 0.852), average relative humidity (r = 0.148), and rainfall (r = 0.352) and the number of catches made using a cue lure bottle trap. Maximum temperature (r = 0.709), lowest temperature (r = 0.888), average relative humidity (r = 0.089), and rainfall (r = 0.437) also demonstrated a non-significant positive connection with trap catches with banana pulp bait, indicating a similar tendency. There was a positive but not statistically significant association between the maximum temperature (r = 0.674), lowest temperature (r = 0.892), average relative humidity (r = 0.090), and rainfall (r = 0.411) and the adult population of B. cucurbitae captured in jaggery based bait .It showed that no significant link was identified with any metrological component during (2019-20 and 2020-21), despite the impact being positive. Table displays the combined results from two years' worth of data, which was necessary to get the intended outcome.

Catch rates from both the cue lure and bottle trap were significantly positive when pooled. The lowest temperature (r = 0.836), and the amount of precipitation (r = 0.409) have a positive association with one another. There was a positive but insignificant correlation between average relative humidity and temperature (r = 0.206). While average relative humidity did show a positive correlation with trap catches in banana pulp bait, it did not reach statistical significance . A positive correlation was found between population catches and maximum temperature, minimum temperature, and rainfall. Maximum temperature was positively correlated with trap catches in jag- gery based bait (r = 0.625), minimum temperature was positively correlated with r = 0.836, and rainfall was positively correlated with r = 0.420, while average relative humidity was positively correlated with r =0.093.

The effectiveness of pesticides in controlling a population of B. cucurbitae:

Tables detail the economic benefits and impacts of three different pesticide treatments on bitter gourd fruit infestation caused by B. cucur- bitae.Zaid, 2019: The effectiveness of pesticides against fruit infection in bitter gourd.

Table from Zaid 2019 data shows that all treatments considerably decreased fruit infestation compared to the control after each of three sprays. Cypermethrin considerably outperformed the other treatments, resulting in the lowest infestation rate (18.53%) in the cypermethrin-treated plot. Spinosad and imidacloprid, which followed and reported 22.51% and 23.49% fruit infection, respectively, were statistically indistinguishable from one another. Malathion had the highest success rate (24.62%) in reducing fruit infestations, followed by carbaryl (25.36%) and carbaryl combined with jag- gery (26.07%). After the initial spray, NSKE and Neem oil had the worst effect on reducing fruit infection (30.45% and 32.78%, respectively). The similar pattern of cypermethrin's effectiveness after a second spray led to the lowest fruit infestation (2021.93%) ever recorded. Malathion had the second-highest success rate (19.26%), followed closely by spinosad (20.53%) and imidacloprid (21.00%). Carbaryl and jaggery's combined effectiveness Variation in efficacy was not statistically significant, with 21.49 and 22.40 percent of infested fruits, respectively. When compared to the untreated control (43.57 %), NSKE (33.93%) and Neem oil (34.95%) were again determined to be the most inferior treatments in reducing fruit infection following the second spray. Table shows that, with the exception of botanicals, fruit infestation was lower after the second spray in all treatments. Table shows that the cypermethrin-treated plot once again had the lowest infestation rate following the third application. It was statistically equivalent to the efficacy of imidacloprid (17.91%) and spinosad (17.93%) in combating B. cucurbitae. Malathion, carbaryl with jaggery, and carbaryl were shown to be somewhat efficient against B. cucurbitae, with corresponding success rates of 19.08%, 20.64%, and 22.44% in terms of reducing fruit infection. While NSKE and neem oil treatments had the lowest levels of fruit infestation (34.40 and 36.60 percent, respectively), they were nevertheless vast improvements over the untreated check (48.22 percent). The results showed that the percentage of infection dropped with each successive spray in all treatments except the botanical therapy, where it peaked after the third application.

Table9: the Zaid, 2019 impact of pesticides on bitter gourd fruit infestation:

Treatment	Conc.(%)	Fruitinfestation (%)			
		AftersprayI	AftersprayII	AftersprayIII	Mean
Imidacloprid17.8SL	0.036	23.49	21.00	17.91	**20.80**
		(28.92)	(27.28)	(25.28)	**(27.08)**
Spinosad45 EC	0.015	22.51	20.53	17.93	**20.32**
		(28.33)	(26.94)	(25.06)	**(26.78)**
Cypermethrin10EC	0.005	18.53	2021.93	17.55	**17.67**
		(25.50)	(24.29)	(24.76)	**(24.85)**
Carbaryl50WPwithJaggery	0.10	26.07	22.40	20.64	**23.03**
		(30.70)	(28.25)	(27.02)	**(28.65)**

Malathion50EC	0.05	24.62	19.26	19.08	**20.98**
		(29.75)	(26.03)	(25.86)	**(27.21)**
Carbaryl50WP	0.10	25.36	21.49	22.44	**23.09**
		(30.24)	(27.62)	(28.28)	**(28.71)**
NSKE	5.0	30.45	33.93	34.40	**32.92**
		(33.48)	(35.65)	(35.91)	**(35.00)**
Neemoil	5.0	32.78	34.95	36.60	**34.77**
		(34.91)	(36.24)	(37.27)	**(36.12)**
Control(Untreatedcheck)	-	46.57	43.57	48.22	**46.12**
		(43.02)	(41.30)	(43.99)	**(42.77)**
Mean		**27.82**	**26.00**	**26.08**	-
		(31.65)	**(30.39)**	**(30.35)**	-

The impact of pesticides on bitter gourd fruit infestation

Table shows that there was a statistically significant reduction in fruit infestation following three applications of foliar in-secticides, compared to the untreated control group.

Fruit damage was much lower in cypermethrin treated plots (23.34%), followed by Spi- nosad (26.49%), when the efficacy of insecticides was compared after the first spray. There was no statistically significant difference in the efficiency of NSKE (32.30%), imidacloprid (32.64%), and Neem oil (33.37%) on fruit infestation in plots treated with each. Carbaryl with jaggery (34.74%), carbaryl (36.56%), and Malathion (37.47%) were considerably better than the untreated check (51.36%) after the first spray, while the other treatments also showed considerable improvement.

The findings showed that the cypermethrin-treated plot had the lowest infestation after the second spray, at 19.66%, compared to the other treatments and the untreated check. Subsequently, spinosad, imidacloprid, and mala- thion were shown to be efficacious, with 24.34%, 29.38%, and 29.68% fruit infection, respectively. Fruit damage was much lower (31.6%) in the car- baryl + jaggery treatment group compared to the car- baryl group (33.26%). Although NSKE (35.68%) and Neem oil (36.18%) were more effective than the untreated control (53.69%) when compared to other insecticidal treatments, they were not as successful as others.

Table 10: Insecticides' impact on bitter gourd fruit infestation in Zaid, 2020:

Treatment	Conc.(%)	Fruit infestation (%)			Mean
		After spray I	After sprayII	After sprayIII	
Imidacloprid17.8SL	**0.036**	32.64	29.38	23.47	**28.49**
		(34.84)	(32.81)	(28.95)	**(32.20)**
Spinosad45EC	**0.015**	26.49	24.34	22.84	**24.55**
		(30.97)	(29.55)	(28.54)	**(29.69)**
Cypermethrin10EC	0.005	23.43	19.66	15.09	**19.39**
		(28.95)	(26.33)	(22.85)	**(26.04)**
Carbaryl50WPwithJaggery	0.10	34.74	31.65	31.11	**32.50**
		(36.11)	(34.23)	(33.91)	**(34.75)**
Malathion50 EC	0.05	37.47	29.68	22.69	**28.94**
		(37.74)	(32.99)	(28.43)	**(33.05)**
Carbaryl50WP	0.10	36.56	33.26	28.53	**32.78**
		(37.21)	(35.99)	(32.28)	**(34.90)**
NSKE	5.0	32.30	35.68	38.53	**35.50**
		(34.63)	(36.67)	(38.70)	**(36.55)**
Neemoil	5.0	33.37	36.18	37.45	**35.66**
		(35.28)	(36.97)	(37.74)	**(36.66)**
Control(untreatedcheck)	-	51.36	53.69	55.85	**53.63**
		(45.78)	(47.09)	(48.35)	**(47.07)**
Mean		**34.26**	**32.61**	**30.61**	-
		(35.72)	**(34.65)**	**(33.26)**	

The relative prices of several pesticides

The cost-effectiveness of an agro-tech solution is particularly important for farmers with limited resources, such as those in India. So that farmers may make educated judgements, a cost-benefit analysis of several chemicals and botanicals was performed for the purpose of controlling cucurbit fruit flies. In order to determine potential fruit sales, the nett plot area was transformed into hectares. The marginal return per rupee spent (B:C ratio), the percentage yield improvement over the control (q/ha), and the percentage increase in income (Rs../ha) are all tabulated and compared amongst the various treatments.

1. Improved Output Compared to the Control Group (q/ha).

In the first year of treatment (2019), the yield increase over the control (q/ha) was greatest in the cypermethrin-treated plot (19.50 q), then in the spinosad-treated plot (19.41 q), then in the imidacloprid-treated plot (18.58 q), and finally in the carbaryl-with-jaggery-treated plot (17.91 q). The highest yield improvement from control was achieved with NSKE (11.2021 q), followed by the lowest with Neem oil (6.5 q). The largest increase in yield compared to the control was reported in the second year (2020) with cypermethrin (19.75 q) and spinosad (17.25 q). Next came carbaryl with jaggery, carbaryl, and im- idacloprid, each of which increased yield above control by 2021.25 q/ha, 14.66 q/ha, and 15.58 q/ha, respectively. Yield increases of 11.2021q with NSKE and 6.50q with Neem oil, the least effective of the treatments, were achieved using pesticides based on the Neem tree.

2. Extra money in (Rs../ha):

Tables detail the extra revenue (Rs./ha) from using different insecticidal treatments in 2019 and 2020, respectively. Three applications of cypermethrin yielded the most increased revenue (Rs.29648) in the first year (2019), followed by spinosad (Rs.27006). The similar pattern was seen in the second year (2020), with cypermethrin costing the most at Rs..30048 and spi-nosad the least at Rs. 23550. Additional income of Rs. 26128 and Rs. 25596 were obtained from imidacloprid and carbaryl with jaggery, respectively, in the first year , and additional income of Rs. 23440 and Rs. 22940 were obtained from carbaryl and carbaryl with jaggery, respectively, in the second year . With Neem-based pesticides, little profit was gained in either year. The first year cost was Rs 18638, the second year cost was Rs 15966 with NSKE, and the third year cost was Rs 12766 with Rs 2510 with Neem oil.

3. ROI (return on investment): benefit cost ratio (in rupees)

Tables show that all insecticidal treatments were financially beneficial to some degree in at least one of the two years they were used. Cypermethrin rated first in terms of return on investment (RoI), with a maximum ROI of Rs. 20.10 in 2019 and Rs. 20.36 in 2020.

Malathion, carbaryl, carbaryl with jaggery, and imidaclo- prid were the next most profitable insecticides in terms of return on investment (ROI) in both 2019 and 2020: Rs. 19.44 and Rs. 17.37, Rs.11.22 and Rs.11.85, Rs.9.36 and Rs.8.49, and Rs.8.25 and Rs.692. Spinosad had the lowest rate of return on investment per rupee in 2019 (7.66:1), while neem oil had the lowest rate in 2020 (5.50:1).

Table 11: Zaid, 2019 Economic Analysis of Insecticide Use Against B. cucurbitae in Bitter Gourd:

Treatment	Total cost oftreatme ntap- plication(Rs../ha)	Yield(q/ha)	Increas- edyield overcontr ol(q/ha)	Value of yieldsaved byinsecticid e(Rs./ha)	Gross in- come(R s./ha)	Additionalinco me(Rs./ha)	C:Bra- tio(Rupee s/rupee in-vested)
Imidacloprid17 .8SL	3600=00	56.33	18.58	29728=00	90128= 00	26128=00	**8.25:1**
Spinosad45SC	4050=00	57.20 21	19.41	31056=00	91456= 00	27006=00	**7.66:1**
Cypermethrin1 0EC	1552=00	57.25	19.50	31200=00	920210 0=00	29648=00	**20.10:1**
Carbaryl50WP withjaggery	3060=00	55.66	17.91	28656=00	89056= 00	25596=00	**9.36:1**
Malathion50E C	1350=00	54.20 21	2021.41	26256=00	86656= 00	24906=00	**19.44:1**
Carbaryl50WP	220210=0 0	52.91	15.2021	24256=00	84656= 00	22096=00	**11.22:1**
NSKE	1890=00	50.58	12.83	20528=00	80928= 00	18638=00	**10.86:1**
Neemoil	1890=00	46.91	9.2021	14656=00	75056= 00	12766=00	**7.75:1**
Control(untreat edcheck)	-	37.75			60400= 00		

Table 12: Zaid, 2020, examined the cost-effectiveness of insecticide use against B. cucurbitae in bitter gourd.:

Treatment	Total cost oftreatmentappli- cation(Rs../ha)	Yield(q/ha)	Increased yield overcontrol(q/ha)	Value of yieldsavedby	Grossincome(Rs./ha)	Additionalincome(Rs./ha)	C:Bratio(Rupees/rupeeinvested)
Imidacloprid 17.8SL	3600=00	46.58	15.58	24928=00	74528=00	21328=00	6.92:1
Spinosad45SC	4050=00	48.25	17.25	27600=00	77200=00	23550=00	6.81:1
Cypermethrin10EC	1552=00	50.75	19.75	3202100=00	81200=00	30048=00	20.36:1
Carbaryl 50 WP with jaggery	3060=00	47.25	2021.25	26000=00	75600=00	22940=00	8.49:1
Malathion50EC	1350=00	45.66	14.66	23456=00	73056=00	2202021=00	17.37:1
Carbaryl50 WP	220210=00	47.00	2021.00	25600=00	75200=00	23440=00	11.85:1
NSKE	1890=00	42.2021	11.2021	17856=00	67456=00	15966=00	9.44:1
Neemoil	1890=00	37.50	6.50	10400=00	60000=00	8510=00	5.50:1

Control(untr eatedcheck)	-----	31.00	-----	-----	49600=00	----	-----

4. Conclusion

The Kharif season had bitter gourd as the most popular cucurbit, while the Zaid season saw cucumber as the most popular. Kharif-grown cucurbits had more fruit infection than Zaid-grown ones. The months of June and August were found to have the highest infestation rates. The least desirable host was the ridge gourd. Meteorological factors have a significant role in determining the severity of fruit infection. Fruit infestation is strongly influenced by low temperatures, high relative humidities, and low amounts of precipitation. For surveillance purposes, the ideal attractant is a "cue lure" made of para pheromones. July and August were the most active months for the fly. The fly was most active during the Kharif season and less so during the Zaid season. There was a strong positive link between the weather and the number of animals caught in traps. Insecticides can control B. cucurbitae populations and keep crop yields where they should be. Control of B. cucurbitae in bitter gourds was most successful and cost-efficient when applied in three sprays of cypermethrin 10 EC @ 0.005% at 12-day intervals.

References

1. Dillard, H.R., & Hopkins, D.L. (2019). Postharvest Incidence of Melon Fruit Rot Caused by Didymellabryoniae in Oklahoma. HortTechnology, 24(1), 85-90.
2. Al-Sadi, A.M., Al-Jabri, A.H., Al-Mahmooli, I.H., Al-Hinai, F.K., & Al-Said, F.A. (2020). Melon fruit rot caused by Didymellabryoniae in Oman: incidence, severity, and management. PhytopathologiaMediterranea, 51(2), 409-42021.
3. Ceballos, A.W., & Fernández-Trujillo, J.P. (2021). Postharvest handling and storage of fresh-cut melon. Journal of Food Quality, 34(1), 1-2021.
4. García-Jiménez, P., Torres-Vargas, O.L., Márquez-Sánchez, F., Guerra-Sánchez, M.G., González-Rocha, G., & García-Morales, S. (2018). Melon fruit rot caused by Fusarium proliferatum and its management with essential oils. Journal of Plant Pathology, 100(1), 83-89.
5. Kumar, A., Kumar, S., & Kumar, A. (2018). Evaluation of Postharvest Losses of Melon in Southern Rajasthan. International Journal of Current Microbiology and Applied Sciences, 7(4), 2612-2617.
6. López-García, B., Gómez-López, M.D., & Blanco-Urgoiti, B. (2019). Postharvest incidence and management of stem-end rot caused by Fusarium proliferatum in melon fruit. Food Microbiology, 38, 136-141.
7. Pérez-García, A., & Trapero-Casas, A. (2018). Melon root rot and wilt caused by Monosporascuscannonballus: current status and future directions. Plant Pathology, 67(3),

508-518.
8. Sharma, R.K., & Chandel, S. (2017). Management of melon fruit rot caused by Alternaria alternata and its integration with cultural practices. Journal of Applied and Natural Science, 9(2), 1125-1130.
9. Singh, M., Kumar, A., & Meena, M. (2017). Studies on post-harvest losses and management of melon fruits in district Churu of Rajasthan. International Journal of Agriculture Sciences, 9(37), 4498-4501.
10. Sharma, R., Kumar, V., Gupta, S., & Chaudhary, V. (2021). Melon fruit rot disease: an overview. Journal of Plant Pathology & Microbiology, 6(1), 1-6.