Biological Forum – An International Journal **15(8): 447-453(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Insecticides use Pattern in Bitter Gourd *Momordica charantia* L., at Western Region of Tamil Nadu

Naga Rani Ch.[1], K.N. Ragumoorthi[1], M. Suganthy[1], B. Vinothkumar[1], T. Elaiyabharathi[1] and T. Saraswathi[2]

[1]Department of Agricultural Entomology,
Tamil Nadu Agricultural University (TNAU), Coimbatore, India.
[2]Department of Medicinal and Aromatic plants, (TNAU), Coimbatore, India.

(Corresponding author: K.N. Ragumoorthi)*
(Received: 09 June 2023; Revised: 24 June 2023; Accepted: 27 July 2023; Published: 15 August 2023)
(Published by Research Trend)

ABSTRACT: An extensive survey was carried out to record the extent of insecticide usage to control major pests of bitter gourd in five major bitter gourd cultivating blocks of Coimbatore District in Tamil Nadu, India. The information was gathered from fifty progressive bitter gourd cultivating farmers from selected locations. The results revealed that farmers used thirty six different insecticides and seven insecticide mixtures to manage major pests such as fruit fly, gall fly and jassids in bitter gourd. Among insecticides the usage of imidacloprid 17.8 SL was more (94.40 %) in the bitter gourd ecosystem followed by spinetoram 11.7 SC (83.70 %), flonicamid 50WG (60.60 %), chlorantraniliprole 18.5 SC (49.40 %), spinosad 45 SC (56.00 %) and bifenthrin10 EC (45.90 %). Insecticide mixture spirotetramat 11.01 + imidacloprid 11.01 SC - 240 SC was used by more than 25 per cent of the bitter gourd growers in different locations. Survey results revealed that, almost 90.49 per cent of farmers were using power sprayer for spraying operation and 85.88 per cent farmers spray insecticides at morning hours and about 65.97 mean per cent farmers spray insecticides at an interval of 6 to 7 days. Hardly few farmers (21.5 %) executed spraying based on the status of pest infestation, 91.05 per cent farmers disposed the waste containers in the neglected areas and 92.16 per cent farmers not aware of label information. The primary source of information for insecticide spray was retail shop owners (62.22 %) and 73.45 per cent of farmers did not follow any safety precautions like wearing a safety apron, masks or gloves while taking spraying operation. The survey revealed that even though farmers had an adequate knowledge in mixing and measuring insecticides, they were a bit less aware of the recommended insecticides, dosage, safe harvest intervals, label claims, and personnel protection during spray operations.

Keywords: Bitter gourd, Survey, Insecticides use pattern, Imidacloprid, Disposal.

INTRODUCTION

India is primarily an agriculture-based nation where numerous fruits and vegetables can potentially be grown due to its diverse favourable climate and fertile soils which guarantees the supply of greatest variety of fruits and vegetables. As a result, it ranks second after China in terms of global production of fruits and vegetables. Vegetables are not equally produced in the country throughout the year in which majority of the vegetables are cultivated in the winter, but it's production in summer is tremendously low (Anon., 1993). Tamil Nadu contributes six per cent of total vegetable production in India. In order to boost storage during the lag phase, cucurbitaceous vegetables play an essential role (Rashid and Shabji 1993). Among different cucurbits, bitter gourd (*Momordica charantia* L.,) is one of the most significant warm-season crops, which is often grown during the monsoon and summer months. It was grown on an area of 112.6 lakh ha, generating 1433.2 metric tonnes annually at a productivity of 12.71 metric tonnes per ha in India. In Tamil Nadu, bitter gourd was cultivated in Coimbatore, Dharmapuri, Salem, Erode, Dindigul, and Cuddalore districts with an area of 2360 ha, production of 44,380 metric tonnes per annum and productivity of 24.68 metric tonnes per ha (Indiastat, 2023). It plays an essential role in the human diet for maintaining good health which contains 2.1g of protein, 1.0g of minerals, 1.7g of fibre, 10.6g of carbohydrates, 0.07 mg of thiamine, 0.06 mg of riboflavin, and 96 mg of vitamins in 100 g edible portion (Gopalan *et al.,* 1971).

The bitter gourd yield is influenced by the variety, the season, the growing technique, and a few other factors like plants being green, succulent and juicy, are often and ideal host for insect pest and diseases (Shah *et al.,* 2018). However, impact of abiotic and biotic stresses greatly reduces the fruit yield. Bitter gourd is plagued with several insect pests of which fruit fly, aphids, whiteflies and semi loopers causes more damage (Butani and Jotwani 1984). Yield losses due fruit fly alone, varies from 19-70% in different cucurbits (Kabir

et al., 1991). Farmers currently rely completely on synthetic chemicals for the management of different pests in bitter gourd. Farmers use several pesticides suggested by pesticide retailers because no registered chemical insecticides suggested for bitter gourd by Central Insecticide Board & Registration Committee (CIB & RC) except chlorantraniliprole 18.50 % SC. Insecticides like imidacloprid, spinosad, cyantraniliprole, acetamiprid, thiomethoxam, emamectin benzoate, spiromesifen, and diafenthurion were used against sucking pests in gourds, without approval by CIB & RC (Hou *et al*., 2014; Kodandaram *et al*., 2017; Ran *et al*., 2018). Providing education on pesticide safety and protection standards for farm workers to mitigate health risks; owing to their insufficient knowledge of the harmful effects of pesticide exposure, farmers and farm workers rarely adopt precautionary measures while applying pesticides (Khan, 2012; Ejaz *et al.*, 2004). With this background, an extensive survey had been carried out across five blocks of the Coimbatore districts in Tamil Nadu to assess the pesticide usage pattern in bitter gourd.

MATERIALS AND METHODS

The experimental survey was conducted at Thondamuthur, Pollachi South, Pollachi North, Kinathukadu, Anaimalai blocks of Coimbatore district in Tamil Nadu to assess the pesticide usage patterns, handling techniques, farmers' proficiency, skills, and experience in applying them, as well as their knowledge on primary insects associated with bitter gourd. Sampling was carried out by using random sampling method. The total sample size was 50 selected progressive bitter gourd farmers. In order to gather data, an interview questionnaire prepared and used to interview each farmer during March to April 2023. In order to give farmers ample time to think about the questions and provide thoughtful responses, the survey was done in chronological order. Since the majority of farmers had completed secondary and college education, it was not essential to explain the challenges in great detail. To ensure their fair participation, farmers were first given a thorough explanation of the investigation purpose. None of the farmer objected to respond in the survey. The farmers in the study area were able to provide the essential information through memory recall gained from years of experience even though they didn't keep records. The questionnaire is sub divided into the following sections.

Section 1:	Pertaining to general information (farmer name, address, age, education, family particulars like size of the family)
Section 2:	Crop production information (Size of the land holding, soil type, cropping pattern, crop stage, season, name of the variety, spacing, irrigation and fertilizers used).
Section 3:	Details on pest incidence and insecticide used (Name of the pest, name of the insecticide used with dose, trade name, cost of insecticide, volume of spray fluid used, number of spraying, frequency of spraying).
Section 4:	Additional practices known and adopted for pest management (Bio pesticides, pheromone traps, light traps, natural enemies, knowledge on natural enemies and recommended pesticides).
Section 5:	Pesticide usage pattern (source of information on recommended pesticides such as dealer / neighbour / media / seminars / agricultural department/scientists, attention towards labels, measurement and mixing of pesticide, safety methods followed, dosage of insecticides, type of sprayer used, time of spraying, waiting period followed, handling and disposal of pesticide containers, most common problem observed, first aid).

For the analysis of data, every factor relating to knowledge level, information sources, reason for pesticide use, and challenges with safe pesticide use has been clearly defined and categorised. Survey data gathered from various sources has been analyzed and categorised in accordance with the necessary information in order to derive pertinent conclusions. Descriptive statistical methods are used to assess respondents' socioeconomic status. The data was coded, entered into a Microsoft Excel spreadsheet and then analyzed by using Microsoft Excel software.

RESULTS AND DISCUSSION

The study results revealed that, 93.38 per cent of bitter gourd growers were male, whereas only 6.62 per cent of farmers were female. Majority (44.45 %) of the bitter gourd farmers comes under old age group (between 40-55) followed by middle (in between 30 to 40 years) and young (between 25-30) age groups with 40.86 per cent and 14.66 per cent respectively. Majority of bitter gourd farmers have completed their secondary level (32.76 %) education followed by higher level (20.88 %), primary level (17.75 %), middle level (16.63 %) and graduation level (5.18 %). According to Ríos-Gonzalez *et al.* (2013), literate farmers have a better understanding of the effects of pesticides on health and environment than illiterate ones. Though a majority of the farmers surveyed were literate, and many of bitter gourd farmers in Coimbatore had graduate level of education, knowledge acquirement on scientific practices of pest management was found to be less. According to the survey, marginal farmers with less than 2.5 acres accounted for 32.22 per cent, medium farmers with 2.5 to 10 acres accounted for 57.71 per cent and large farmers with more than 10 acres accounted for only 10.06 per cent. Mean data revealed that, 71.22 per cent of farmers cultivated bitter gourd as a mono crop and 28.77 per cent of farmers inter cropped bitter gourd along with coconut. About 85.77 per cent of farmers followed drip irrigation and 14.22 per cent of farmers followed flood method of irrigation in bitter gourd cultivation.

The data reveal that the majority of the respondents apply pesticides to destroy insects/ pestsand to control

diseases. Rijal *et al.* (2018) reported that, in Nepal, about 80 per cent of farmers were using chemicals/pesticides for pest management. Our study indicates that farmers are well aware of the yield losses caused by pests and diseaseswhich stood as a major reason for pesticides use. During the survey period, pests such as fruit flies *Bactrocera cucurbitae* (Coquillet), bitter gourd gall midge, *Lasioptera bryoniae* (Schiner) was observed to cause more damage. The lists of insect pests observed in the bitter gourd ecosystem by the farmers were given in the Table 2. About 94.44 per cent farmers reported fruit fly infestation in all the blocks. The infestation of the gall midge was high in Pollachi south (92.30 %) followed by Pollachi north (64.28 %), Kinathukadu (66.6 %). Muthukumar *et al*. (2020) mentioned that gall midge, *Lasioptera bryoniae* (Schiner) infestation in bitter gourds is higher in Coimbatore district compared to other districts in Tamil Nadu. Fields were infested with jassids (100%), white flies (100%), thrips (81.22%), and aphids (72.28%), according to the information provided by the farmers at the time of the survey. Infestations of caterpillars (63.6%) and gall midges (61.31%) have been detected in bitter gourd. Major pests include jassids, white flies, thrips, and aphids, which not only inflict direct harm to crops by devouring on them but also indirect damage since they are vectors of several viral diseases. None of the farmer reported red spider mite, *Tetranychus urticae* (Koch) in bitter gourd but its infestation is high in other gourd crops like ridge gourd. Farmers have made an attempt to control mites in ridge gourd by using bitter gourd sap, but there is no control of mites in ridge gourd. The variation in pest dynamics between different blocks is neglectable but in various districts it is high due to differences in cultivar/hybrids, sowing time, crop stage, geographical location of the study area, climatic differences, particularly temperature and rainfall, which influences pest population (Meenambigai *et al.,* 2017).

The information obtained from the survey on the pesticides used by the bitter gourd farmers of the five blocks of coimbatore district in Tamil Nadu is presented in the Table 3. About 36 different kinds of insecticides were used by the farmers to manage the bitter gourd pests. The pesticide usage profile on the bitter gourd growing regions in Coimbatore showed that imidacloprid 17.8 SL (94.40 %), spinetoram 11.7 SC (83.70 %), flonicamid 50 WG (60.60%), chlorantraniliprole 18.5 SC (49.40 %), spinosad 45 SC (56.00 %), bifenthrin10 EC (45.90 %), acetamiprid 20 SP (41.60%), cyantraniliprole 10.26 OD (2.96 %), novaluron 10 EC (25.60 %), dimethoate 30 EC (26.40 %), fipronil 5 SC (23.90 %),diafenthiuron 50 WP (18.10%), thiamethoxam 25 WG (20.10 %), flubendiamide 20 WG (11.30%), indoxacarb 15 EC (11.40 %), emamectin benzoate 5 SG (6.72 %), thiacloprid 21.7 SC (7.68 %), fenvalerate 20 EC (2.96 %), cypermethrin 25 EC (5.83 %), buprofezin 25 SC(2.96 %) were used by the bitter gourd farmers. Azardiractin was used only by 24 per cent of the surveyed farmers and the insecticide mixtures spirotetram at 11.01 + imidacloprid 11.01 - 240 SC used by 25 per cent of the farmers (Table 4) followed by acephate 50 + imidacloprid 5 WG-55WG (24 %), beta-cyfluthrin 8.49 + imidacloprid 19.81 300 OD (16.52 %), novaluron 5.25 + indoxacarb 4.5 SC (13.60 %), flubendiamide 8.33 + deltamethrin 5.56 SC (8.63 %) were used by farmers.

Almost 90.4 per cent of farmers were using power sprayer and only 9.50 per cent of farmers used hand operated knapsack sprayer (Table 5). Among surveyed farmers 85.88 per cent have carried out spraying at morning hours and 14.12 per cent carry out spraying at evening hours. About 65.97 mean per cent of farmers followed an interval of 6 to 7 days and 10.91 mean per cent of farmers followed an interval of 8 to 10 days in between two sprays. Hardly few farmers, about 21.5 per cent executed spraying based on the status of pest infestation. After the completion of spraying operation, 91.05 per cent of the farmers disposed the waste containers in the neglected areas and remaining 8.95 per cent burried them inside soil. Mean of 84.94 per cent of farmers followed no waiting period and harvested the fruits on the same day of spraying, while 1.54 per cent of farmers followed one to three days before harvesting and about 8.76 per cent of farmers followed four to seven days waiting period and 4.76 per cent farmers followed the waiting period as per recommendations. The source of information on insecticides to be sprayed was mostly obtained from the retail shop owners (62.22 %), rarely from government officials (21.25), companies (1.3%) and fellow farmers (15.10 %). Almost all the farmers followed the dose recommendation given by the retail shop owners. While spraying, about 73.45 mean per cent of farmers and spray man did not follow any safety precautions like wearing a safety apron, masks or gloves. None of the farmer has gone for spraying based on ETL, while 16.34 per cent of them sprayed based on initial symptoms and majority of them sprayed without any observations (83.66 %) in the belief of prevention is better than cure. Majority of farmers (92.16 per cent) have no attention towards label information and 7.84 per cent have little knowledge on labels. Majority of the farmers (87.8 3%) spray the chemical in approximate dose, only a few farmers follow the recommendation dosage.

Table 1: Socio economic status of bitter gourd farmers at western region of Tamil Nadu.

Sr. No.	Particulars	Respondents (%)					
		L1	L2	L3	L4	L5	Mean ± SD
1.	**Gender**						
	Male	85.71	92.30	100.00	88.88	100.00	93.38 ± 6.47
	Female	14.28	7.69	0.00	11.11	0.00	6.62 ± 6.47
2.	**Age group**						
	Young (Under 25-30 years)	14.28	7.69	12.50	22.22	16.66	14.66 ± 5.35
	Middle (Above 30 to 40 years)	21.42	38.46	50.00	44.44	50.00	40.86 ± 11.86
	Old (More than 40-515 years)	64.28	53.84	37.50	33.33	33.33	44.45 ± 13.93
3.	**Education level**						
	Illiterate	0.00	0.00	12.50	0.00	16.66	5.83 ± 8.12
	Primary level	14.28	23.07	12.50	22.22	16.66	17.75 ± 4.72
	Middle level	14.28	23.07	12.50	0.00	33.33	16.63 ± 12.44
	Secondary level	35.71	46.15	37.50	11.11	33.33	32.76 ± 13.03
	Higher Secondary level	28.57	23.07	25.00	11.11	16.66	20.88 ± 6.96
	Graduation level	7.14	7.69	0.00	11.11	0.00	5.18 ± 4.97
4.	**Land holdings**						
	Marginal (< 2.5 acres)	42.85	30.76	37.50	33.33	16.67	32.22 ± 9.82
	Medium (2.5 - 10 acre)	50.00	53.84	62.50	55.55	66.67	57.71 ± 6.74
	Large (>10 acres)	7.14	15.38	0.00	11.11	16.67	10.06 ± 6.76
5.	**Cropping pattern**						
	Mono cropping	78.571	69.230	75	66.666	66.66	71.22 ± 5.33
	Inter cropping	21.428	30.769	25	33.333	33.333	28.77 ± 5.33
6.	**Irrigation system**						
	Drip irrigation	92.85	84.61	62.50	88.88	100.00	85.77 ± 14.18
	Flooding method	7.14	15.38	37.50	11.11	0.00	14.22 ± 14.18
7.	**Farming experience**						
	Low (Up to 5 years)	28.57	23.07	37.50	55.55	50.00	38.94 ± 13.78
	Medium (Above 5 to 10 years)	57.14	69.23	50.00	33.33	50.00	51.94 ± 13.03
	High (More than 10 years)	14.28	7.69	12.50	11.11	0.00	9.11 ± 5.64

L1 - Pollachi North, L2 - Pollachi South, L3 - Thondamuthur, L4 - Anaimalai, L5 - Kinathukadavu

Table 2: Pests reported in the bitter gourd ecosystem at western region of Tamilnadu.

Sr. No.	Common name	Stage of crop	L1	L2	L3	L4	L5	Mean ± SD
1.	Fruit flies	Fruiting	100.00	100.00	100.00	88.88	83.30	94.44 ± 7.85
2.	Gall midge	Vegetative	64.28	92.30	50.00	33.33	66.60	61.31 ± 21.84
3	Jassids	Vegetative & Flowering	100.00	100.00	100.00	100.00	100.00	100.00 ± 0.00
4.	Whitefly	Vegetative	100.00	100.00	100.00	100.00	100.00	100.00 ± 0.00
5.	Thrips	Vegetative & Flowering	78.57	69.23	75.00	100.00	83.30	81.22 ± 11.68
6.	Aphids	Vegetative	64.28	84.61	62.50	66.66	83.30	72.28 ± 10.78
7.	Leaf caterpillar	Vegetative	42.85	61.53	75.00	88.88	50.00	63.65 ± 18.63
8.	Pumpkin beetles	Vegetative	28.57	46.15	62.50	0.00	16.60	30.77 ± 24.4
9.	Semi loopers	Vegetative	0.00	7.69	12.50	0.00	0.00	4.038 ± 5.78
10.	Leaf miner	Vegetative	0.00	7.69	12.50	0.00	0.00	4.038 ± 5.78
11.	Spotted leaf beetle	Vegetative	7.14	7.69	0.00	11.11	0.00	5.18 ± 4.75
12.	Flower feeder	Flowering	7.14	15.38	0.00	0.00	0.00	4.50 ± 6.82
13.	Stink bug	Vegetative	7.14	7.69	0.00	0.00	16.60	6.30 ± 6.88

L1 - Pollachi North, L2 - Pollachi South, L3 - Thondamuthur, L4 - Anaimalai, L5 – Kinathukadavu

Table 3: List of insecticides used in bitter gourd ecosystem at western region of Tamilnadu.

Sr. No.	Name of insecticide	Usage by bitter gourd farmers (%)					
		L1	L2	L3	L4	L5	Mean
1.	Acephate 75 SP	14.20	15.30	12.50	11.11	0.00	10.60
2.	Acetamiprid 20%SP	57.14	53.80	25.00	22.22	50.00	41.60
3.	Afidopyropen 50 DC	42.80	69.20	62.50	66.66	33.30	54.90
4.	Azardiractin	28.50	15.30	37.50	22.22	16.60	24.00
5.	Bifenthrin10 EC	78.50	69.23	37.50	11.11	33.30	45.90
6.	Broflanilide 20 SC.	21.40	30.76	37.50	0.00	33.30	24.60
7.	Buprofezin 25 SC	7.14	7.69	0.00	0.00	0.00	2.96
8.	Carbosulfan 25 EC	7.10	15.38	0.00	11.11	33.33	13.30
9.	Chlorantraniliprole 18.5 SC	85.71	76.92	12.50	22.22	50.00	49.40
10.	Clothianidin 50 WDG	7.14	7.69	0.00	11.11	16.66	8.52
11.	Cyantraniliprole 10.26 OD	7.14	7.69	0.00	0.00	0.00	2.96
12.	Cypermethrin25 EC	0.00	0.00	12.50	0.00	16.66	5.83
13.	Chlorfenapyr 10 SC.	7.14	7.69	0.00	0.00	0.00	2.96
14.	Diafenthiuron 50 WP	28.5	23.00	0.00	22.22	16.66	18.10
15.	Dimethoate 30 EC	50.00	46.15	25.00	11.11	0.00	26.40
16.	Dinotefuran 20 SG	7.14	7.69	0.00	0.00	0.00	2.96
17.	Emamectin benzoate 5 SG	7.14	15.38	0.00	11.11	0.00	6.72
18.	Fenvalerate 20 EC	7.14	7.69	0.00	0.00	0.00	2.96
19.	Fipronil 5 SC	50.00	30.76	0.00	22.22	16.66	23.90
20.	Flonicamid50 WG	92.85	92.30	62.50	22.22	33.33	60.60
21.	Flubendiamide 20 WG	14.20	7.69	12.50	22.22	0.00	11.30
22.	Fluxametamide 10 EC	64.20	61.50	37.50	0.00	33.30	39.30
23.	Imidacloprid 17.8 SL	100.00	100.00	100.00	88.88	83.33	94.40
24.	Indoxacarb 15 EC	14.20	15.38	0.00	11.11	16.66	11.40
25.	Lambda cyhalothrin 5 EC	0.00	0.00	12.50	0.00	16.66	5.83
26.	Novaluron 10 EC	42.80	61.53	12.50	11.11	0.00	25.60
27.	Phenthoate 50 EC	14.20	7.69	0.00	22.22	16.66	12.10
28.	Pyriproxyfen	0.00	15.38	0.00	11.11	16.60	8.63
29.	Pymetrozine 50 WG	7.14	7.69	0.00	0.00	0.00	2.96
30.	Spinetoram 11.7 SC	100.00	92.30	87.50	88.88	50.00	83.70
31.	Spinosad 45 SC	57.10	53.80	75.00	44.44	50.00	56.00
32.	Spiromesifen 22.9 SC	7.14	7.69	0.00	0.00	0.00	2.96
33.	Spirotetramat 15.3 OD	7.14	15.38	0.00	11.11	0.00	6.72
34.	Sulfoxaflor 21.8 SG	7.14	7.69	0.00	0.00	0.00	2.96
35.	Thiamethoxam 25 WG	28.50	15.30	12.50	11.11	33.33	20.10
36.	Thiacloprid 21.7 SC	7.14	7.69	12.50	11.11	0.00	7.68

L1 - Pollachi North, L2 - Pollachi South, L3 - Thondamuthur, L4 - Anaimalai, L5 - Kinathukadavu

Table 4: List of insecticides mixtures used in bitter gourd ecosystem at western region of Tamilnadu

Sr. No.	Name of insecticide	Usage by bitter gourd farmers (%)					
		L1	L2	L3	L4	L5	Mean
1.	Spirotetramat 11.01 + Imidacloprid 11.01 SC - 240 SC	42.80	30.76	12.50	22.22	16.66	25.00
2.	Acephate 50 + Imidacloprid 5 WG - 55 WG	28.50	38.40	25.00	11.11	16.66	23.96
3.	Beta-Cyfluthrin 8.49 + Imidacloprid 19.81- 300 OD	42.80	23.00	0.00	0.00	16.66	16.52
4.	Novaluron 5.25 + Indoxacarb 4.5 SC	28.57	23.00	0.00	0.00	16.67	13.60
5.	Flubendiamide 8.33 + Deltamethrin 5.56 SC	0.00	15.38	0.00	11.11	16.60	8.63
6.	Phenthoate 45 + Cypermethrin 6 - 51% EC	7.14	7.69	0.00	0.00	0.00	2.96
7.	Buprofezin 20 + Acephate 50% WP	7.14	7.69	0.00	0.00	0.00	2.97

L1 - Pollachi North, L2 - Pollachi South, L3 - Thondamuthur, L4 - Anaimalai, L5 - Kinathukadavu

Table 5: Pesticide spray parameters in bitter gourd ecosystem at western region of Tamilnadu.

Sr. No.	Name of insecticide	Pesticide spray parameters (%)					
		L1	L2	L3	L4	L5	Mean
1.	**Type of sprayer**						
	Hand sprayer	7.14	15.38	25.00	0.00	0.00	9.50
	Power sprayer	92.85	84.61	75.00	100.00	100.00	90.49
2.	**Pesticide application time**						
	Morning	85.71	92.31	62.50	88.89	100.00	85.88
	Evening	14.29	7.69	37.50	11.11	0.00	14.12
3.	**Frequency of spraying**						
	6 to 7 days	78.57	84.62	50.00	66.67	50.00	65.97
	8 to 10 days	14.29	0.00	12.50	11.11	16.67	10.91
	Based on pest infestation	7.14	7.69	37.50	22.22	33.33	21.58
4.	**Pre-harvest interval followed**						
	0 day	92.86	84.62	75.00	88.89	83.33	84.94
	1 to 3 days	0.00	7.69	0.00	0.00	0.00	1.54
	4 to 7 days	0.00	7.69	25.00	11.11	0.00	8.76
	As per recommendation	7.14	0.00	0.00	0.00	16.67	4.76
5.	**Pesticide container disposal**						
	Neglected areas	92.86	84.62	100.00	77.78	100.00	91.05
	Randomly in field	0.00	0.00	0.00	0.00	0.00	0.00
	Buried in soil	7.14	15.38	0.00	22.22	0.00	8.95
6.	**Source of information on pesticide recommendation**						
	Retail shops	57.14	69.23	62.50	55.56	66.67	62.22
	Fellow farmers	14.29	15.38	12.50	33.33	0.00	15.10
	Government officials	21.43	15.38	25.00	11.11	33.33	21.25
	Company persons	7.14	0.00	0.00	0.00	0.00	1.43
7.	**Decision of spraying**						
	Based on ETL	0.00	0.00	0.00	0.00	0.00	0.00
	Blanket spraying	85.71	92.31	62.50	77.78	100.00	83.66
	On initial symptoms	14.29	7.69	37.50	22.22	0.00	16.34
8.	**Attention towards label information**						
	Yes	92.86	84.62	100.00	100.00	83.33	7.84
	No	7.14	15.38	0.00	0.00	16.67	92.16
9.	**Measurement of insecticides**						
	Bottle cap	100.00	100.00	87.50	77.78	100.00	93.06
	Approximate	0.00	0.00	12.50	22.22	0.00	6.94
10.	**Safety measures taken at the time of spray**						
	No measures taken	78.57	69.23	75.00	77.78	66.67	73.45
	Hand gloves	7.14	15.38	0.00	0.00	0.00	4.51
	Mask alone	7.14	0.00	12.50	11.11	16.67	9.48
	Cap	7.14	15.38	12.50	11.11	16.67	12.56
11.	**Dose**						
	Recommended dose	14.29	7.69	0.00	22.22	16.67	12.17
	Approximate dose	85.71	92.31	100.00	77.78	83.33	87.83

L1 - Pollachi North, L2 - Pollachi South, L3 - Thondamuthur, L4 - Anaimalai, L5 - Kinathukadavu

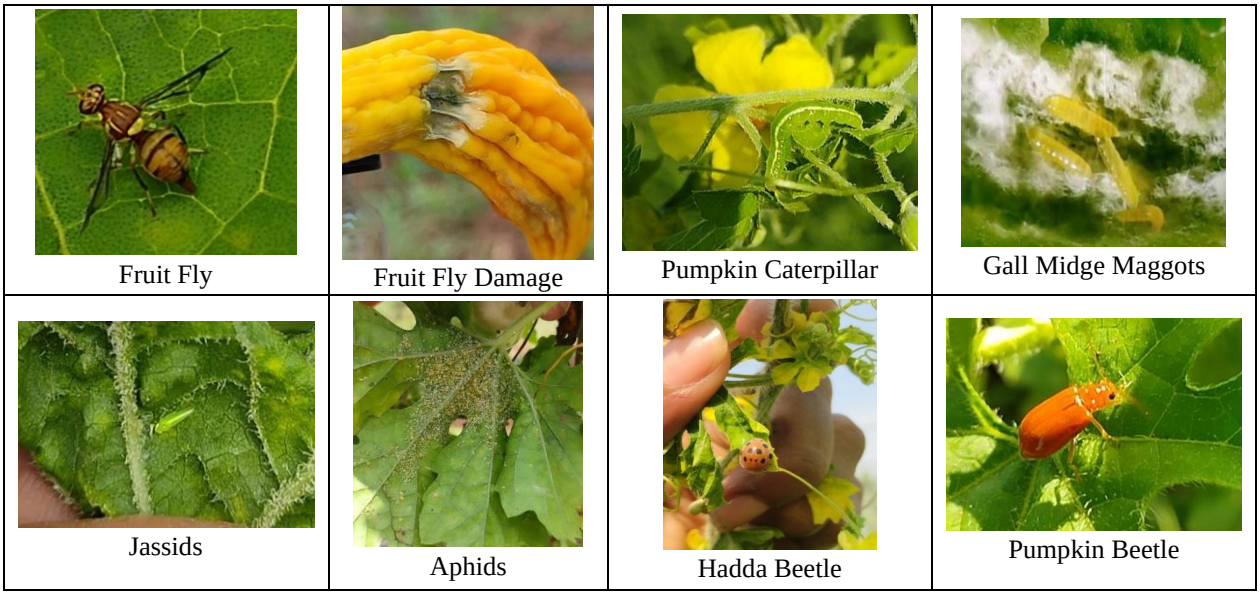

Fig. 1. Insect pests of bitter gourd recorded in surveyed area of Tamil Nadu.

CONCLUSIONS

The majority of pesticides used by the farmers were not having label claim or unregistered to bitter gourd. Hence the fate of insecticides in the environment and harvested produce were unknown. There is huge scope to increase the farmer's knowledge level in choosing recommended insecticides, their dosage, waiting period, label claim and personnel protection during spray operation. Our study necessitates the importance of training to the farmers by means of field demonstrations to enhance the proper information about pest management.

FUTURE SCOPE

Multiple authors from different parts of the country and the world have described a wide variety of insects. However, Tamil Nadu still lacks an adequate amount of literature on the pests that attack bitter gourds. The primary objective of this investigation is to figure out the present status of the bitter gourd's major pest. This study mainly helps in our understanding of the pests that damage bitter gourds, the issues that farmers come across, and the methods for managing those issues which will help to develop a supervised field trail and IPM modules to control pests in future.

Author contributions. First author has contributed in collecting and analysis of data and writing of this paper. All other authors have contributed in conceiving and designing analysis and guiding the 1st author in all technical aspects of this research work.

Acknowledgement. I take this opportunity to express my heartful gratitude to ICAR for the financial assistance, and Department of Agricultural Entomology, TNAU, Coimbatore for taking up this study.

Conflict of interest. None.

REFERENCES

Anonymous (1993). Research and development of vegetable crops. Paper presented in workshop on March 9-10 at Bangabandhu Sheikh Mujibur Rahman Agricultural University, (BSMRAU), (Institute of Post Graduate Studies in *Agriculture***,** IPSA). Gazipur, pp 1-7.

Butani, D. K. & Jotwani, M. G. (1984). *Insects in Vegetables*. *Periodical Expert Book Agency.* Vivek-Vihar, Delhi, India. 69-79.

Ejaz, S., Akram, W., Lim,C.W., Lee, J. J. & Hussain, I. (2004). Endocrine disrupting pesticides: a leading cause of cancer among rural people in Pakistan. *The Journal of Clinical & Experimental Oncology, 26*(2), 98-105.

Gopalan, C., Ramasastry, B. V. & Balasubramanyam, B. V. (1971). Nutritive values of Indian Foods, *National Institute of Nutrition, Indian Council of Medical Research*, Hyderabad.

Hou, X., Lei, S., Qiu, S., Guo, L., Yi, S. & Liu, W. (2014). A multi-residue method for the determination of pesticides in tea using multi-walled carbon nanotubes as a dispersive solid phase extraction absorbent. *Food Chemistry, 153*, 121-129.

Indiastat (2023). Selected state-wise area, production, yield of bitter gourd in India (2022-2023-1st advance estimates). https://www.indiastat.com

Kabir, S. M. H., Rahman, R. & Molla, M. A. S. (1991). Host plants of *Dacinae* fruit flies (Diptera: Tephritidae) of Bangladesh. *Bangladesh Journal of Entomology, 1*, 60-75.

Khan, M. (2012). Adverse Health Experiences, Risk Perception and Pesticide use Behavior. A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in economics, *Federal Urdu University of Arts, Science & Technology* (FUUAST) Islamabad.

Kodandaram, M. H., Kumar, Y. B., Banerjee, K., Hingmire, S., Rai, A. B. & Singh, B. (2017). Field bioefficacy, phytotoxicity and residue dynamics of the insecticide flonicamid (50 WG) in okra [*Abelmoschus esculenta* (L) Moench]. *Crop protection, 94*, 13-19.

Meenambigai, C., Bhuvaneswari, K., Mohan, K. & Sangavi, R. (2017). Pesticides usage pattern of okra, *Abelmoschus esculentus* (L) Moench in Tamil Nadu. *Journal of Entomology and Zoology Studies, 5*(6), 1760-1765.

Muthukumar, M., Sridharan, S. & Kennedy, J. S. (2020). Incidence of Bitter Gourd gall midge and assessment of Farmers management practices. *Annals of Plant Protection Sciences, 28*(3), 232-234.

Ran, W. A. N. G., Wang, J. D., Che, W. N. & Chen, L. U. O. (2018). First report of field resistance to cyantraniliprole, a new anthranilic diamide insecticide, on *Bemisia tabac*i MED in China. *Journal of integrative agriculture, 17*(1), 158-163.

Rashid, M.M. & Shabji, K. P. (1993). *In: Shabji Bijnan*. Bangla Academy, Dhaka, Bangladesh, 254-356.

Rijal, J. P., Regmi, R., Ghimire, R., Puri, K. D., Gyawaly, S. & Poudel, S. (2018). Farmers' knowledge on pesticides safety and pest management practices: A case study of vegetable growers in Chitwan, Nepal. *Sustainable Agriculture intensification Nepal, 8*, 1-11.

Ríos-González, A., Jansen, K. & Sánchez-Pérez, H. J. (2013). Pesticide risk perceptions and the differences between farmers and extensionists: Towards a knowledge-in-context model. *Environmental research journal, 124*, 43-53.

Shah, J., Louis, J., Patel, M. & Nalam, V. (2018). *Arabidopsis*-green peach aphid interaction: rearing the insect, no-choice and fecundity assays, and electrical penetration graph technique to study insect feeding behavior. *Bio-protocol, 8*(15), e2950-e2950.

How to cite this article: Naga Rani Ch., K.N. Ragumoorthi, M. Suganthy, B. Vinothkumar, T. Elaiyabharathi and T. Saraswathi (2023). Insecticides use Pattern in Bitter Gourd *Momordica charantia* L., at Western Region of Tamil Nadu. *Biological Forum – An International Journal, 15*(8): 447-453.