Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(6): 1112-1119

Received: 03-09-2018
Accepted: 05-10-2018

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Intensity, farmer's perception and knowledge of pesticide use against diamondback moth (*Plutella xylostella* L.) in cabbage

CG Sawant, CS Patil and RV Patil

Abstract
Insecticide usage pattern of selected farmers from Ahmednagar, Pune and Nashik district of western Maharashtra indicated that, farmers relied mostly on chemical pesticides to control the insect pests of cabbage. Irrespective of location, farmers from these locations used conventional insecticides. Among three cabbage growing areas, the use of conventional insecticides was maximum by the farmers from Pune districts (1.43 kg a.i. ha^{-1} $season^{-1}$) followed by Ahmednagar (1.22 kg a.i. ha^{-1} $season^{-1}$) and Nashik districts (1.07 kg a.i. ha^{-1} $season^{-1}$). As regards, use of novel insecticides, farmers from Nashik district used 0.38 kg a.i.ha^{-1} $season^{-1}$ followed by Pune (0.24 kg a.i. ha^{-1} $season^{-1)}$ and Ahmednagar district (0.20 kg a.i. ha^{-1} $season^{-1}$). Very few farmers from above locations used biopesticides. The most commonly used conventional insecticides were triazophos, quinalphos, dimethoate, dichlorvos, cypermethrin, profenophos and chlorpyriphos. About 50 per cent farmers were aware of natural enemies. Nearly 60 per cent farmers knew about the recommended insecticides and their doses on cabbage. Majority of the farmers were aware of the residual effects of insecticides, but they did not follow any precautions to avoid harmful effects. Majority of the farmers did not know about safe waiting period for harvesting of cabbage after application of insecticides. Majority of the farmers sprayed at an interval of 7-10 days giving 5-7 rounds of spraying during cropping season of cabbage.

Keywords: Cabbage, usage, insecticides, conventional, biopesticides, natural enemies, residue, safe waiting period

Introduction
Cabbage has traditionally been used for its medicinal properties as well as for food. It has anti-inflammatory property and contains chemicals which can prevent cancer. Food in the cabbage family inhibit the growth of breast, stomach and colon cancer due to phytochemicals (indoles) which tend to burn up the female hormones, estrogen and ward off cell changes that lead to colon cancer [1]. Cabbage has high nutritive value, supplying essential vitamins, proteins, carbohydrates and vital minerals [2]. Cabbage is known to contain water (93 ml), protein (15 g), fat (0.2 g), carbohydrates (4 g), fibre (0.8 g), calcium (40 mg), iron (0.5), vitamin potency (30 iu), thiamine (0.05 mg), riboflavin (0.05 mg), nicotinamide (0.3 mg) and ascorbic acid (40 mg) [3].
Despite its medicinal and food uses, cabbage production in India is beset with several constraints. These include the high cost of inputs such as pesticides, fertilizers and attack of different insect pests and diseases. The cabbage crop is attacked by a number of insect pests. Among them diamondback moth, *P. xylostella* is the most destructive pest [4, 5] and it is one of the limiting factors for the successful cultivation and production of cruciferous crops [6].
In order to control the damage caused by pests, farmers use substantial amount of organophosphates throughout the period of crop growth and sometimes even at the fruiting stage. Indiscriminate use of pesticides particularly during fruiting stage and non-adoption of safe waiting period results in accumulation of residues in consumable vegetables pose serious threat to the health of consumers.
Excessive and indiscriminate use of pesticides not only increases the cost of production but also results in human health problems and environmental pollution. According to WHO estimates, one million cases of pesticide poisoning occur every year and consequently there are 20,000 deaths globally [7]. The most damaging ecological disturbance of injudicious use of pesticides is the existence of high concentration of pesticide residues in food chain, including cereals, pulses, vegetables, fruits, milk and milk products (including mother's milk), fishes,

poultry, meat products and water. Pesticides are responsible for hundreds of cases of poisoning in the developing world, where information and training on the potential negative health effects of these chemicals is often lacking. While the impact of the indiscriminate use of toxic chemicals is widely acknowledged, the economic costs of this misuse are less well known. This has held back investment in the necessary health and safety programmes that can safeguard people's well-being.

Besides leaving residues in the environment, the consistent use of pesticides to control pests and disease vectors, adversely effecting non-target organisms. These negative aspects have thus over shadowed the benefits of pesticides, initiating a need to think of alternatives [8]. The effect of chemical pesticide use is more harmful in vegetables. Hence, the objectives of this research, therefore, were to document the intensity, farmer's perception and various pesticides used by the farmers in cabbage production.

Materials and Methods

The research work was a field survey to assess the use of pesticides to control insect pests on cabbage in predominantly cabbage growing areas which was also the major export area of cabbage in Maharashtra state. The survey was undertaken in Ahmednagar, Pune and Nasik districts of western Maharashtra during October, 2015 to December, 2016 on the basis of questionnaire. The questionnaire was prepared (Table 1.) in the form of closed and multiple choice format questions with Yes/No as answers. The information on insecticide usage pattern was generated from 50 farmers who were interviewed for usage and application of insecticides on cabbage. Interviews were carried out in the appropriate local language i.e. Marathi. A record of all collected information was analyzed.

Results and Discussion

1. Usage pattern of insecticides in cabbage against diamondback moth (*Plutella xylostella* L.)

During survey, the respondents were asked about their awareness and technical know-how about insecticide use, sources of recommendations, residues persistence of insecticides, their safe waiting periods, etc. The results are presented in Table 2 and 3.

Survey of insecticide usage pattern on cabbage explicated wide range of insecticides used by the farmers in respective areas. Farmers relied on conventional insecticides as well as novel insecticides and also on bio-pesticides. The usage of insecticides was largely dependent on the incidence of pests in the respective locality. Farmers used organophosphates, carbamates, neonicotinoids, synthetic pyrethroids and newer chemicals for the control of diamondback moth (DBM).

The most widely used insecticides to control cabbage pests in the study areas during the survey period are shown in Table 2. The results showed that organophosphates were used predominantly by the farmers.

Table 1: Prepared questionnaire for insecticides usage pattern in cabbage

SN	Particulars	Answers (Y/N)
1	Name of Farmer	
2	Address	
3	Year	
4	Total cultivable land	
5	Area under cabbage	
6	Area under other crop	
7	Pest occurrence	
	Aphids	
	Diamondback moth	
	Leaf Webber	
	Other pests	
8	Bio-agents observed	
9	Insecticides used against aphids	
10	Insecticides used against Diamondback moth	
11	Yield q/ha	
12	Volume of spray	
15	Information on application of bio-pesticides (if any)	
16	Do you know about natural enemies?	
17	Do you know about recommended pesticides in cabbage?	
18	How do you measure pesticides (bottle/ top approximately)?	
19	How do you mix the pesticides in the water-bare hand/sticks?	
20	Source of information for recommended pesticides-Agril. Dept /Neighbour /Media/Dealers/Scientists/ University	
21	Do you know safe waiting period?	
22	Do you know about effects of pesticide residues?	
23	Signature of farmer	
24	Signature of Surveyor	

a) Ahmednagar District

Survey reports revealed that in Ahmednagar district, share of conventional insecticides was highest (81.01%) followed by novel insecticides (12.37%) and biopesticides (6.64%). Majority of the farmers used combination of insecticides. The data on quantity of insecticides used by individual farmer in respect of cabbage (Table 2; Fig 1 and 2) revealed that total consumption of conventional insecticides was 1.22 kg a.i. ha^{-1} which was 81.01 per cent. Whereas, consumption of novel insecticides was @ 0.20 kg a.i. ha^{-1} (12.37%), followed by biopesticides (0.10 kg a.i. ha^{-1}) in cabbage crop.

The quantity of organophosphate insecticides used by

individual farmer was 1.04 kg a.i ha^{-1} for the control of insect pests in cabbage. Among the insecticides groups, per cent shares of organophosphates, carbamates and synthetic pyrethroid were 69.06, 6.77 and 5.18 per cent, respectively. Whereas, use of novel insecticides *viz.,* neonicotinoids, oxadizines, avermectins, spinosyns, diamides, pyrroles, phenylpyrazoles and IGR's was 3.67, 1.00, 0.44, 0.72, 1.39, 0.84, 0.60 and 3.71 per cent, respectively. Insecticides used were triazophos, quinalphos, acephate, chlorpyriphos, profenophos, dichlorvos, cypermethrin, imidacloprid, thiamethoxam, fipronil, emamectin benzoate, indoxacarb, flubendiamide, spinosad, chlorantraniliprole and cyantraniliprole.

b) Pune District

It could be seen that the total quantity of insecticides used by the individual farmer was 1.79 kg a.i. ha^{-1} season^{-1} in Pune district (Table 2; Fig 3 and 4).

Further, it was revealed that share of conventional insecticides was highest (79.39%), followed by novel insecticides (13.91%) and biopesticides (6.70%). Total consumption of conventional insecticides was 1.43 kg a.i.ha^{-1} (79.39%) as compared to 0.24 kg a.i. ha^{-1} (13.91%) of novel insecticides and 0.12 kg a.i. ha^{-1} (6.70%) of biopesticides.

The quantity of organophosphorous insecticides used by individual farmer was 1.36 kg a.i. ha^{-1} for the control of insect pests in cabbage. Among the insecticidal groups, per cent shares of organophosphates, carbamates and synthetic pyrethroids were 75.83, 0.38 and 3.18 per cent, respectively. Whereas, use of novel insecticides *viz.,* neonicotinoids, oxadizines, avermectins, spinosyns, diamides, pyrroles, phenyl pyrazoles and IGR's was 2.92, 3.02, 0.40, 0.80, 1.98, 1.07, 1.24 and 2.48 per cent, respectively. Insecticides included triazophos, quinalphos, acephate, chlorpyriphos, profenophos, dichlorvos, cypermethrin, imidacloprid, fipronil, emamectin benzoate, indoxacarb, flubendiamide, spinosad, chlorantraniliprole and cyantraniliprole.

c) Nashik District

From surveyed information in Nashik district, it could be seen that the total quantity of insecticides used by the individual farmer was 1.65 kg a.i. ha^{-1} season^{-1} (Table 2; Fig 5 and 6).

Further, it was revealed that share of conventional insecticides was highest (65.10%), followed by novel insecticides (22.77%) and bio-pesticides (12.14%). Majority of the farmers used individual formulations as well as combination of insecticides. The data on quantity of insecticides used in respect of cabbage revealed that, total consumption of conventional insecticides used by individual farmer was 1.07 kg a.i. ha^{-1} with 65.10 per cent share. This was followed by novel insecticides (0.38 kg a.i. ha^{-1}) and biopesticides (0.20 kg a.i. ha^{-1}) in cabbage crop.

The quantity of organophosphate insecticides used by individual farmer was 0.99 kg a.i. ha^{-1} for the control of insect pests in cabbage. Among the insecticidal groups, per cent shares of organophosphates, carbamates and synthetic pyrethroids were 60.34, 3.16 and 1.60 per cent, respectively. Whereas, the use of novel insecticides *viz.,* neonicotinoids, oxadizines, avermectins, spinosyns, diamides, pyrroles, phenyl pyrazoles and IGR's was 3.39, 3.28, 0.51, 1.09, 5.61, 1.82, 3.47 and 3.60 per cent, respectively. Insecticides included triazophos, quinalphos, acephate, chlorpyriphos, profenophos, cypermethrin, imidacloprid, thiamethoxam, lambda cyhalothrin, fipronil, emamectin benzoate, indoxacarb, flubendiamide, spinosad, chlorantraniliprole and cyantraniliprole.

Irrespective of location, in general farmers used organophosphates and neonicotinoids for the control of sucking pests, and organophosphates, carbamates, synthetic pyrethroids and novel groups of insecticide for the lepidopteran pest control.

The present investigation revealed that, consumption of insecticides for the control of major insects of cabbage was to the extent of 1.51, 1.79 and 1.65 kg a.i. ha^{-1} season^{-1} for Ahmednagar, Pune and Nashik, respectively. The above results are in corroboration with earlier workers. Average usage of 0.563 g a.i.ha^{-1} pesticides in cabbage was reported by Nagendra (2009) [9] in Belgaum district of Karnataka. Jeyanthi and Kombairaju (2005) [10] conducted a survey on pesticide use in cauliflower in Dindigul district of Tamil Nadu and reported that about 87 per cent of cauliflower growers applied pesticides amounting to 4 kg a.i.ha^{-1}. Patrick and Anis (1999) [11] recorded insecticides use in different vegetables such as potatoes (1.30 kg a.i. ha^{-1} annum^{-1}), onions (2.10 kg a.i. ha^{-1} annum^{-1}), brassicas (2.8 kg a.i. ha^{-1} annum^{-1}) and field tomatoes (0.02 kg a.i. ha^{-1} annum^{-1}). Pesticide use in processed vegetables such as asparagus, green peas and sweet corn was relatively low and was mainly concentrated on early season weed and pest control. In contrast, fresh vegetables such as lettuce, brassicas and potatoes tend to had intensive spray programme throughout the growing season. Onions received very frequent pesticide applications. Use rate of pesticides per annum per farmer reached 0.77 L in Gaza Strip and 0.18 L in the West Bank districts in vegetable (Al-Sayed *et al*. 2011) [12]. Patil (2012) [13] reported that farmers from Ahmednagar district used 5.504 kg a.i. ha^{-1} season^{-1} quantity of insecticides against *S. litura*. However, Dhore (2016) [14] reported that 8.595 kg a.i. ha^{-1} organophosphorus insecticides were used against insect pest of brinjal in Ahmednagar. Similarly, Sali (2016) [15] conducted a survey on pesticide use pattern in tomato and revealed that farmers used 5.67 kg a.i ha^{-1} organophosphorus insecticides against insect pests of tomato. Raut (2016) [16] reported that 5.87 kg a.i. ha^{-1} season^{-1} of organophosphorus insecticides were used by chilli growers from Ahmednagar district during cropping season. Patil (2017) [17] reported that usage of insecticides as 6.36, 6.17 and 5.46 kg a.i. ha^{-1} season^{-1} from Ahmednagar, Pune and Jalgaon, respectively in brinjal. Further, reported 6.16, 5.50 and 6.55 kg a.i. ha^{-1} season^{-1} of insecticides used by tomato growers in Ahmednagar, Pune and Nashik, respectively.

2. Response of cabbage growers to the questionnaire from the surveyed area

Responses of cabbage growers to the questionnaire in Ahmednagar, Pune and Nashik districts are presented in Table 3.

a. Awareness about natural enemies

The information generated through survey from Ahmednagar, Pune and Nashik districts indicated that about fifty per cent of the cabbage growers knew about the natural enemies. The data revealed that 54 per cent, 44 per cent and 46 per cent growers of Ahmednagar, Pune and Nashik districts, respectively, were aware of natural enemies of *P. xylostella*.

The present findings are in agreement with Baral *et al*. (2006) [18] who reported that nearly 49 per cent of the farmers were aware of beneficial insects in eggplant fields. Mahantesh and Alka Singh (2009) [19] reported that 41.5 per cent of vegetable

cultivating farmers had knowledge about natural enemies of respective pest. However, only 16 per cent farmers knew about natural enemies in curry leaf according to Ramakrishnan *et al*. (2015) [20].

b. Awareness about recommended insecticides in cabbage

More than 50 per cent farmers knew about the recommended insecticides in surveyed areas of cabbage. In Ahmednagar, 68 per cent farmers were aware of recommendation of insecticides in cabbage as against 52 per cent and 50 per cent in Pune and Nashik, respectively. It was also found that, insecticides were applied without adequate knowledge of insect pest ecology, economic threshold levels and type of pesticides to control specific insect pest, their quantities and method of application. Almost 50 per cent of farmers were reluctant to follow the recommended insecticides as prescribed on the label. Some respondents said that they used excessive dosage of non-recommended chemicals as their neighbor used the same dosage. The major reasons stated by the farmers for use of non-recommended insecticides were lack of knowledge and dealer oriented purchase.

The above findings are in close agreement with Nagendra (2009) [21] who reported that only 11.67 per cent farmers were aware of recommended doses of pesticides in cabbage. According to Chandi *et al*. (2012) [22] 71.9 per cent farmers sprayed non recommended insecticides. Studies of Nagenthirajah and Thiruchelvam (2008) [23] revealed that only 6 per cent farmers were aware of relative plant protection practices and 35 per cent farmers were used higher concentration of pesticides than recommended level. Sutharsan *et al*. (2014) [24] reported that 90 per cent of the vegetable farmers apply pesticides more than the recommended dose. Sharaniya and Loganathan (2015) [25] reported that 51 per cent farmers applied pesticides, 10-20 per cent higher than recommended. Similarly, Sneha *et al*. (2017) [26] reported 40 per cent of the black gram farmers from Nizamabad were aware of recommended pesticides used against different pests.

c. Awareness about application of bio-pesticides

It was found that neem based formulations were one of the commercial biopesticide that farmers commonly applied to control insect pests. This product contains *Azadirachtin* alkaloid with capability to suppress specific lepidopteran larvae without destroying beneficial insects. Unfortunately, lack of understanding on the benefits of biopesticides and less promotion towards the usage was the main reason for the heavy reliance on conventional and synthetic pesticides in vegetable cultivation.

The data revealed that in Ahmednagar district, only 58 per cent farmers knew about bio-pesticides and its application in cabbage. Whereas, in Pune and Nashik, 30 and 68 per cent farmers respectively, were aware of application of bio-pesticides. The rest of the growers used approximate quantity of chemical insecticides depending upon incidence of insect pests.

The present findings corroborate the results of Kamarulzaman *et al*. (2012) [27] who reported that 54.3 per cent vegetable farmers sprayed biopesticides in their farms. Further, concluded that great challenges in promoting biopesticide usage among vegetable farmers though it had proven to be able in controlling pest. Odhiambo *et al*. (2014) [28] reported that only 4.23 per cent biopesticides were used by the farmers in cabbage growing areas.

d. Knowledge of safe waiting period

It was revealed that majority of the farmers did not knew about safe waiting period after application of insecticides. Only 20 per cent cabbage growers from Ahmednagar and Pune district knew about safe waiting period. Whereas, only 36 per cent cabbage growers from Nashik district were aware of safe waiting period.

During rainy seasons, the period between two sprays was shorter due to the quick wash off of insecticides on the crops. Though farmers responded that they were not aware of implication of excessive use of insecticides and the accumulation of insecticide residues in the vegetables. It was also found that some of the farmers sprayed insecticides on cabbage close to harvesting time in order to avoid pest attacks. Meanwhile, the result of present study demonstrated that farmers usually ignore the recommended safe waiting period (seven days and above).

In the present study, it was found that majority i.e. 75 per cent of the cabbage growers did not knew about safe waiting period for insecticide they used. The above findings are in agreement with Muzlon and Mumford (2005) [29] who revealed that more than 50 per cent of cabbage farmers observe 10 to 14 days pre-harvest interval. Amoako *et al*. (2012) [30] reported that 79 per cent of the cabbage farmers continued spraying pesticides during harvesting period; hence no waiting period was adopted. Sutharsan *et al*. (2014) [31] reported that 89 per cent of the farmers harvest their produce before the recommended pre harvest interval. Similarly, Afari Sefa *et al*. (2015) [32] reported that 76.3 per cent vegetable farmers harvest their produce within 7 days after spraying and 1.4 per cent farmers harvest their produce on the same day after spraying. Sneha *et al*. (2017)[33] reported that most of the black gram farmers from Nizamabad district followed common waiting period of 7 days (63.33%) followed by 4 days (26.66%) and 2 days (10%).

e. Awareness about the harmful effects of insecticides residues

Data revealed that farmers tend to ignore the insecticide risk and they kept applying the insecticide within a certain period, even though there was no sign of any pest attacks on the crops. It was a routine practice of farmers that insecticides were usually applied once in every seven to ten days.

Majority of farmers indicated that they were aware of the residues of insecticides, but did not follow any precautions to avoid harmful effects of agrochemicals during their application in the field. Most of the cabbage growers i.e. 86 per cent in Ahmednagar district, 64 per cent in Pune district and 78 per cent in Nashik district, were aware of the harmful effects of insecticide residues on human health. Majority of the farmers knew about ill- effects of insecticides i.e. causing cancer, skin irritation, eye contamination etc. Most of the cabbage growers sprayed the field in the afternoon and harvested cabbage heads in the next day morning for market.

Present findings are in close agreement with earlier work done by Nagendra (2009) [34] who reported that only 15 per cent cabbage growers were aware of lethal effect of pesticides on human health and 76.67 per cent farmers did not follow any protective measures while spraying pesticides. Dey *et al*. (2013) [35] reported that most of the farmers (71%) are not aware of the health hazards caused by the pesticides and also the consequences of their improper handling. Sneha *et al*. (2017) [36] reported that 16.66 per cent of the farmers were aware of the fact that pesticide residues are found in

vegetables. Studies also revealed that more than 85 per cent farmers did not know about any kind of bad effects due to pesticide residues.

Conclusion

Insecticide usage pattern of selected farmers from Ahmednagar, Pune and Nashik district of western Maharashtra indicated that farmers relied mostly on chemical pesticides to control the insect pests of cabbage. Irrespective of location farmers from these locations used conventional insecticides. Survey results revealed that total consumption of insecticides for the control of major insects of cabbage was to the extent of 1.52, 1.79 and 1.65 kg a.i. ha^{-1} $season^{-1}$ for Ahmednagar, Pune and Nashik, respectively. Very few farmers from above locations used biopesticides i.e. Mycoinsecticides and neem based formulations. The most commonly used conventional insecticides were triazophos, quinalphos, dimethoate, dichlorvos, cypermethrin, profenophos and chlorpyriphos.

About 50 per cent farmers were aware of natural enemies. Nearly 60 per cent farmers know about the recommended insecticides and their doses on cabbage. Majority of the farmers indicated that they were aware of the residual effects of insecticides, but they did not follow any precautions to avoid harmful effects. It was also revealed that majority of the farmers did not know about safe waiting period for harvesting of cabbage after application of insecticides. Majority of the farmers sprayed at an interval of 7-10 days giving 5-7 rounds of spraying during cropping season of cabbage.

Acknowledgement

The research findings are the part of the research work of Ph.D. programme of the first author submitted to the Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, District-Ahmednagar, Maharashtra, India and author are dully acknowledge the Ministry of Science and Technology, Department of Science and Technology, GOI, New Delhi for awarding the "INSPIRE FELLOWSHIP" and Pesticides Residue Laboratory, Department of Agricultural Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri, District-Ahmednagar, Maharashtra, India for provided necessary facility during Ph.D. programme.

Table 2: Usage pattern of insecticides in cabbage against diamondback moth (*P. xylostella* L.) during 2015-2016

Sr. No.	Insecticide category	Insecticide group	Quantity of insecticides used by individual farmer (kg a.i. ha^{-1} $season^{-1}$)			Percent share of insecticide used by individual farmer		
			A. Nagar	Pune	Nashik	A. Nagar	Pune	Nashik
1	Conventional insecticides (A)	Organophosphates	1.04	1.36	0.99	69.06	75.83	60.34
		Carbamates	0.10	0.01	0.05	6.77	0.38	3.16
		Synthetic pyrethroids	0.08	0.06	0.03	5.18	3.18	1.60
		Total (A)	1.22	1.43	1.07	81.01	79.39	65.10
2	Novel insecticides (B)	Neonicotinoids	0.06	0.05	0.06	3.67	2.92	3.39
		Oxadiazines	0.02	0.05	0.05	1.00	3.02	3.28
		Avermectins	0.01	0.01	0.01	0.44	0.40	0.51
		Spinosyns	0.01	0.01	0.02	0.72	0.80	1.09
		Diamides	0.02	0.04	0.09	1.39	1.98	5.61
		Pyrroles	0.01	0.02	0.03	0.84	1.07	1.82
		Phenylpyrazoles	0.01	0.02	0.06	0.60	1.24	3.47
		IGR's	0.06	0.04	0.06	3.71	2.48	3.60
		Total (B)	0.20	0.24	0.38	12.37	13.91	22.77
3	Bio-insecticides (C)	Neem based formulations	0.10	0.12	0.20	6.64	6.70	12.14
Grand total (A+B+C)			1.52	1.79	1.65	100	100	100

Table 3: Response of cabbage growers about the questionnaire from the surveyed area of western Maharashtra

SN	Variables	Response of farmers (%)		
1	Types of insecticides used	Ahmednagar	Pune	Nashik
	i) Conventional insecticides	81.01	79.39	65.10
	ii) Novel insecticides	12.35	13.91	22.77
	iii) Bio-pesticides	6.64	6.70	12.14
2	Awareness about natural enemies	54	44	46
3	Awareness about recommended insecticides of cabbage	68	52	50
4	Awareness about application of bio-pesticides	58	30	68
5	Knowledge of safe waiting period	20	20	36
6	Awareness about the harmful effect of insecticide residues	86	64	78

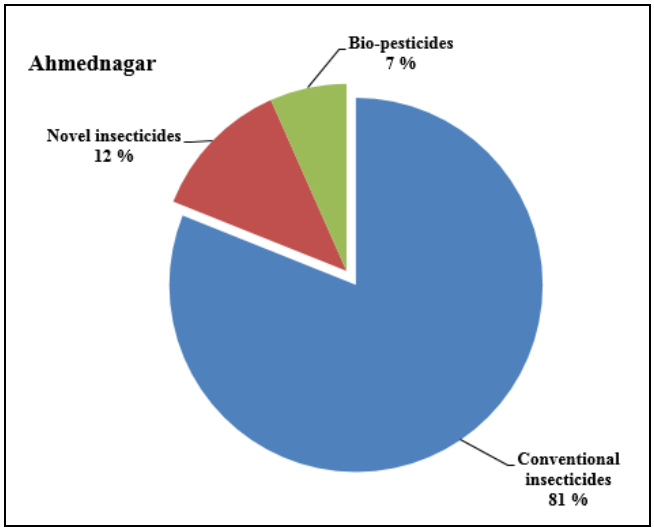

Fig 1: Share of major insecticidal groups against *P. xylostella* in Ahmednagar district

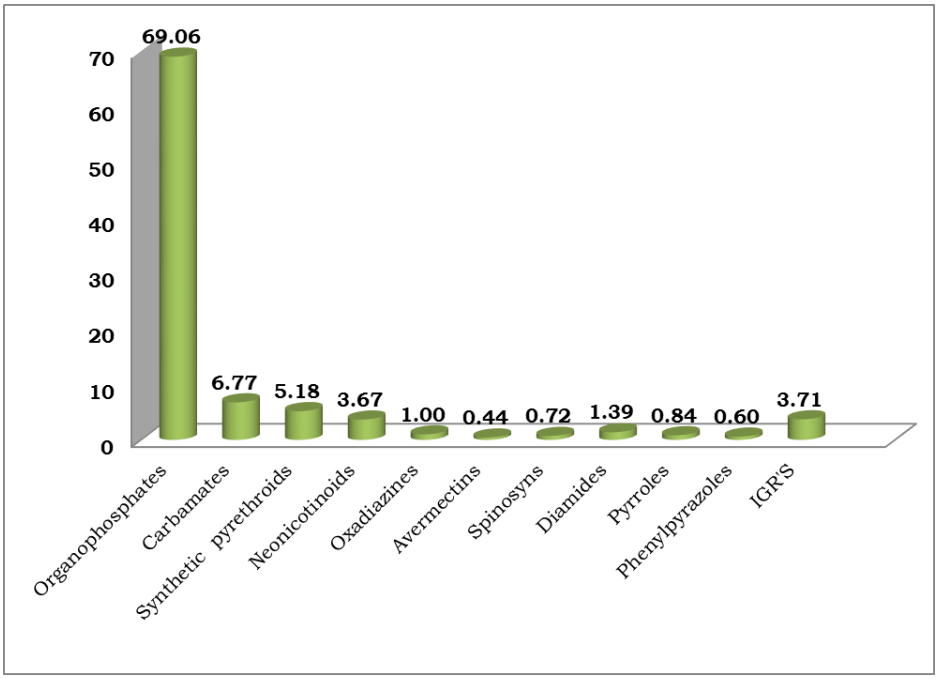

Fig 2: Share of different synthetic insecticides against *P. xylostella* in Ahmednagar district

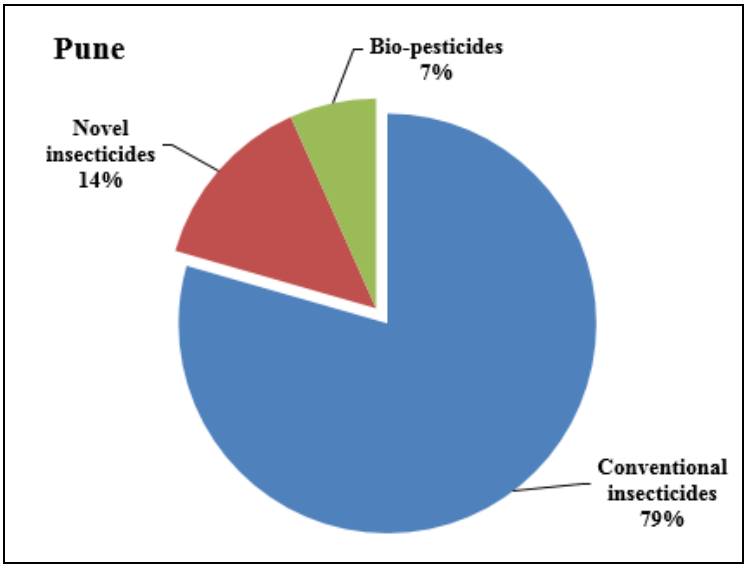

Fig 3: Share of major insecticidal groups against *P. xylostella* in Pune district

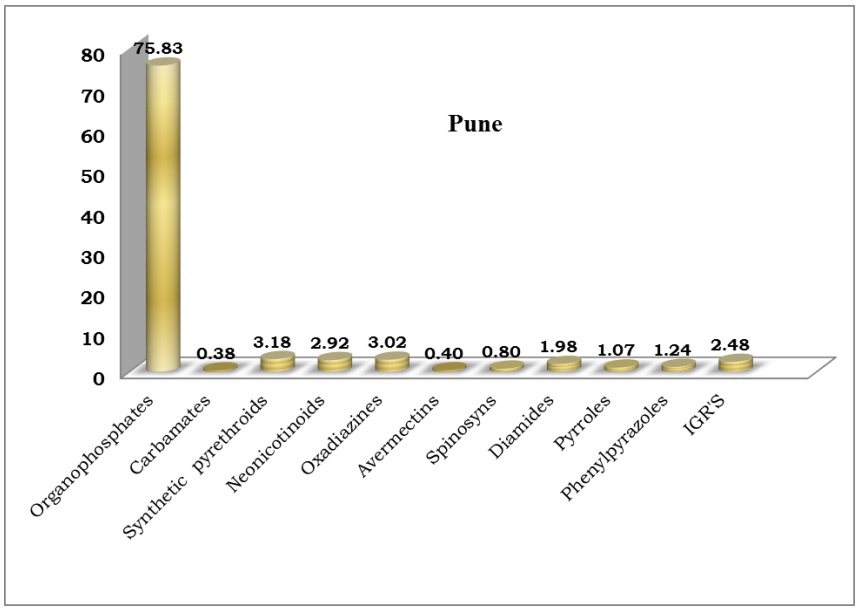

Fig 4: Share of different synthetic insecticides against *P. xylostella* in Pune district

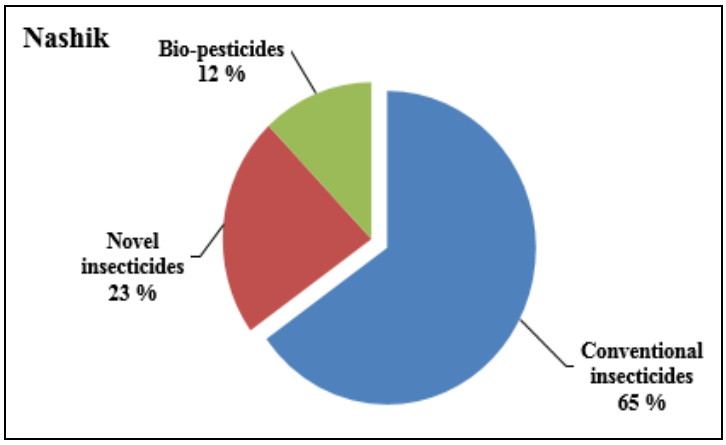

Fig 5: Share of major insecticidal groups against *P. xylostella* in Nashik district

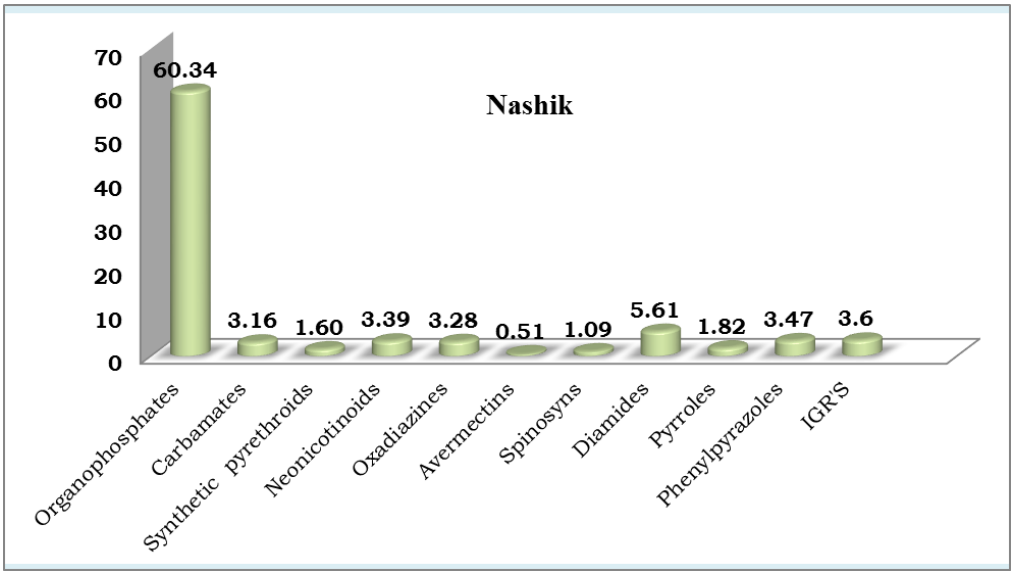

Fig 6: Share of different synthetic insecticides against *P. xylostella* in Nashik district

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