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Study on Pesticide usage Pattern in Carrot Agroecosystem at Temperate Regions of Tamil Nadu

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ABSTRACT: An extensive survey was conducted in the major carrot growing blocks in The Nilgiris district of Tamil Nadu to assess the pesticide usage pattern in carrot agro-ecosystem. The results revealed that the farmers were used 19 different synthetic chemical insecticides on carrot for the management of different pests. Most frequently sprayed chemical groups were neonicotinoids, diamides, and organophosphates. Among the insecticides, imidacloprid (93%), chlorantraniliprole (86%), lambdacyhalothrin (80%), and cyantraniliprole (75%) were sprayed by most of the farmers. Results revealed that, 72. 22 percent of the carrot growers were marginal farmers, 66.67 per cent of the farmers using power sprayer for spraying insecticides, 75.56 and 85.56 per cent of the farmers spraying 7 to 10 number of insecticides in 3 to 4 days interval within the cropping period of 110 days. The knowledge of farmers on personal safety measures during spraying was very limited moreover, their spraying pattern also did not alternate with different pesticide groups, which may result in the development of resistance and a higher dose of the same insecticide. The frequency of spraying reveals massive damping of synthetic pesticides in the carrot ecosystem.

Keywords: Carrot, Pesticides, Sprayers, Neonicotinoids and Safety.

INTRODUCTION

Carrot (*Daucus carota*) is an important tropical and subtropical vegetable crop. It is one of the major Apiaceae family vegetable produced and consumed throughout the Indian subcontinent. India is the leading Carrot producer in the world with the total production of 21.34 lakh metric tonnes which is cultivated in area of 1.18 lakh ha. The major carrot growing states were Haryana, West Bengal, Punjab, Maharashtra, Uttar Pradesh, Madhya Pradesh, Bihar, Tamil Nadu, Karnataka, Assam, and Telangana. Haryana ranks first in carrot production with a share of 20.23 per cent and recorded the highest productivity. During 2021-2022, In Tamil Nadu carrot grown 7290 ha area and produces 1.78 lakh tonnes mainly in the districts of The Nilgiris, Dindigul and Krishnagiri (Indiastat). Carrots (100 g) contain 9.58 g carbohydrates, 0.93 g protein, 2.80 g fibre, 4.74 g total sugars (3.59 g is sucrose, 0.59 g glucose and 0.55 g fructose) and 5.9 g vitamin C (Haq and Prasad 2015). Regardless of the substantial benefits of carrots for human growth and development, their cultivation is facing vast range of difficulties as nation as whole. Pests are a prominent concern among the many issues that affect the cultivation of this crop. The major pest of carrot includes leaf miner (*Liriomyza huidobrensisi*) (Saha *et al.,* 2015) aster leaf hopper (*Macrostele quadrilineatues*), flea bettle (*Systena blanda*), willow carrot aphid (*Cavariella aegopodii*), carrot weevil (*Listronotus oregonensis*), carrot rust fly (*Psila rosae*) they damage the crop by direct feeding on root or by damaging the stem or leaves (Rakshith *et al.,* 2022) Leaf miner (*Liriomyza huidobrensis*) pests is now causing major threat to the cultivation of carrot and also causes higher yield loss in carrot (Saha *et al.,* 2015).

However, excessive and repeated application of pesticides might leave residues in the soil and plants (George *et al.,* 2015). Farmers use insecticides indiscriminately to control these insects. Continuous use of pesticides results in the destruction of natural enemies, development of resistance in the target pest, residual toxicity in the harvested produces and adversely affects the ecological parameters. At present an effective, economically feasible, and environmentally safer chemical also available in the market as alternative to the high toxic pesticides that provides additional protection pest of carrots in the field. Hence, present study was undertaken with an objective of generating basic data on pesticide usage

pattern in carrot ecosystem along with knowledge status of the farmers across different blocks of carrot growing ecosystem in Nilgiris district of Tamil Nadu, India.

MATERIALS AND METHODS

An extensive and intensive survey was conducted in three major carrot-growing blocks of The Nilgiris district: Ooty (11.4102° N, 76.6950° E), Coonoor (1.3530° N, 76.7959° E), and Kotagiri (11.4218° N, 76.8617° E) (Fig. 1). A structured questionnaire was prepared and used to collect pesticide usage patterns in carrot cultivation system. The data was collected from 25 potential carrot growing farmers from each block. The information on size of land holding, types of sprayers used for the plant protection operation, time of application of pesticide, frequency and number of pesticide application in a cropping period, information on pesticide container disposal and source of information on pest management activities were collected All the information were tabulated and mean per cent was taken to draw the conclusion.

RESULT AND DISCUSSION

The results of the survey revealed that about 63 per cent of carrot cultivating farmers in Ooty block was marginal farmers and 36 per cent were small farmers. In Coonoor, 73 per cent and 26 per cent of farmers were marginal and small farmers, respectively. At Kotagiri, 80 percent of farmers were marginal farmers and 20 per cent of farmers were small farmers. Whereas mean data reveals that marginal farmers accounting for about 72 per cent and small farmers were 27 per cent in Nilgiris cultivating carrot. Survey report showed that 60, 73 and 66 per cent of farmers in three blocks were using power operated sprayer as fore mentioned order of blocks and only 40 per cent in Ooty, 26 per cent in Coonoor and 33 per cent in Kotagiri were using hand operated sprayer (Table 1).

According to the chemical spraying pattern and its frequency, nearly 70, 73, and 83 per cent of farmers, spraying seven to ten times at an interval of 3 to 4 days in Ooty, Coonoor, and Kotagiri, respectively. The major sources of information on insecticide recommendation for management of carrot pest were pesticide retailer shops (71 percent), government officials (15 per cent) and fellow farmers (13 per cent) and about 95 to 100 per cent of farmers were found to dispose the pesticide containers in the neglected areas, and one to three per cent of farmers were found to dispose the containers in the field randomly in Ooty, Coonoor, and Kotagiri, respectively (Table 1).

Regarding the usage of insecticides for controlling the pests, the farmers used 19 different insecticides in Nilgiris District of Tamilnadu. In Ooty, 17 insecticides were used by the carrot farmers. Among different insecticides, imidacloprid was used by 93 per cent followed by chlorantraniliprole (86%), lamda cyhalothrin (80%), cyantraniliprole (66%), emamectin benzoate (60%), chlorpyriphos (56%), spinitorum (53%), dimethoate (50%), thiamethoxam (43%), flubendiamide and cypermethrin (40%), profenophos (33%), clothianidin (23%), abamectin (16%), flonicamid (13%), indoxcarb (6%), thiodicarb (3%) (Table 2). Only 14 insecticides were used in Coonoor in which imidacloprid was used by 96 per cent of the farmers. Ninety per cent of the farmers were using chlorantraniliprole followed by lamda cyhalothrin (80%), cyantraniliprole (80%), spinitorum (63%), chlorpyriphos (60%), emamectin benzoate (46%), dimethoate (40%), profenophos (33%) acetamiprid (23%), clothianidin (13%), flonicamid (10%), acephate and indoxacarb (6%). In Kotagiri, 18 insecticides were used by carrot growers. Of which imidacloprid was used by almost 90 percent of the farmers followed by chlorantraniliprole (83%), cyantraniliprole (80%), lambda cyhalothrin (76%), emamectin benzoate (60%), acetamiprid (56%), chlorpyriphos and spinitorum (50%), thiamethoxam (36%), flubendiamide and clothianidin (26%), cypermethrin and profenophos (23%), abamectin and thiodicarb (13%), acephate (10%), flonicamid (6%) and indoxcarb (3%) (Table 2). Based on the cumulative mean imidacloprid, Chlorantraniliprole, lambda cyhalothrin, and cyantraniliprole were used by 93, 86, 80, and 75 per cent of the carrot growing farmers, respectively (Table 2).

Pesticide use patterns on crops must be better understood to minimize arthropod problems as well as sustain crop protection as well as production in order to protect good-quality fruit and vegetable commodities. Earlier studies have also reported the use of organophosphates triazophos, which is principally aimed against carrot fly (*Psila rosae*), and phorate, which is used against carrot fly and willow-carrot aphid (*Cavariella aegopodii*). Over the past 14 years, most other insecticides were replaced by lambda cyhalothrin to control carrot fly, willow-carrot aphid, and a variety of caterpillars, including those of the Silver-Y moth (*Autographa gamma*) and cutworms (*Agrotis segetum*) (Thomas,2003) and their frequency of spraying of insecticides were also once in 3 to 4 days. The majority of farmers (66%) used a power sprayer to administer insecticides. Considering the fact that many pesticides were only applied once to a crop, certain treatments were repeated frequently, and in rare cases, a second chemical was followed after first chemical (Gair and Sly 1974). The vegetable producers use more than 14 different pesticides to control insect infestation and minimise crop losses (Sutharsan *et al.,* 2014). Pesticides were also used without proper knowledge of pest ecology, economic injury levels, and the type of pesticides to control specific insect pests, their quantities and mode of treatment, pre harvest interval, and preventive measures (Ahmad *et al.,* 2012; Joko *et al.,* 2018). Farmers believe that spraying more frequently and employing different pesticides is the only way to solve pest problems (Dunham, 1995). Majority of farmer simple throw pesticide container in neglected areas (Vallarasu *et al.,* 2022). A number of authors (Jhalendra *et al.,* 2018; Ngowi *et al.,* 2007) noted that insecticides were the most commonly used pesticides since insect pests are severe concerns in vegetable farming.

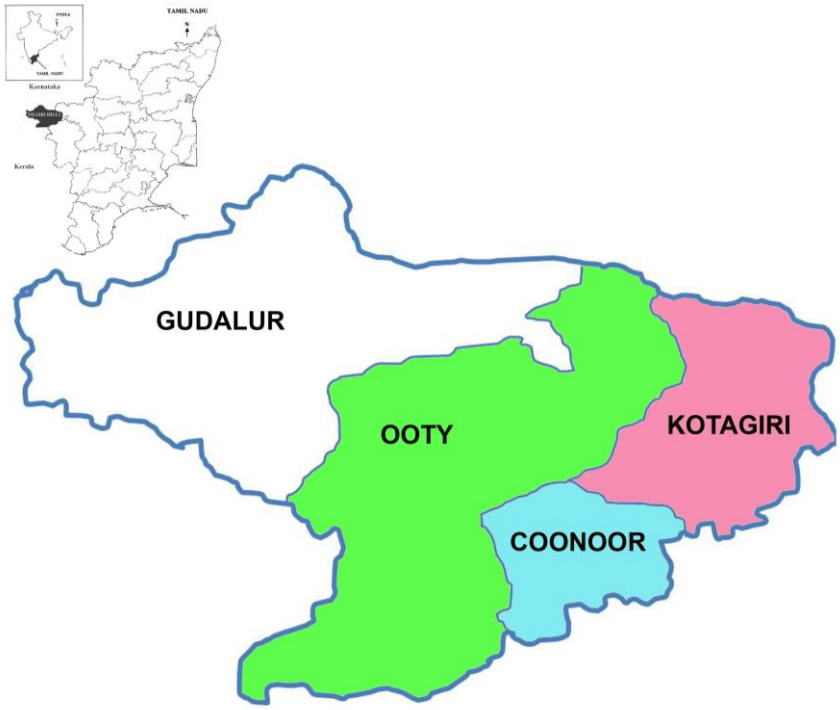

Fig. 1. The Nilgiris district map.

Table 1: Particulars related to pesticide usage pattern on carrot.

Parameters		Locations (%)			
		Ooty	Coonoor	Kotagiri	Mean
Size of land holding	Small farmers	36.67	26.67	20.00	27.78
	Marginal farmers	63.33	73.33	80.00	72.22
	Big farmers	0.00	0.00	0.00	0.00
Types of sprayers used	Hand sprayer	40.00	26.67	33.33	33.33
	Power sprayer	60.00	73.33	66.67	66.67
Pesticide application time	Morning	80.00	90.00	86.67	85.56
	Evening	20.00	10.00	13.33	14.44
Frequency of spraying	3 to 4 days	86.67	76.67	90.00	84.44
	7 to 10 days	13.33	23.33	10.00	15.56
Number of sprayings	4 to 6	30.00	26.67	16.67	24.44
	7 to 10	70.00	73.33	83.33	75.56
Pesticide container disposal	Neglected area	100.00	96.67	100.00	98.89
	Randomly in field	0.00	3.33	0.00	1.11
Source of information on pesticide	Retail shop	63.33	70.00	80.00	71.11
	Fellow farmer	16.67	16.67	6.67	13.33
	Government officals	20.00	13.33	13.33	15.56

Table 2: Pesticide use pattern in on carrot at temperate regions of Tamil Nadu.

Sr. No.	Insecticides	Respondents (%)			
		Ooty	Coonoor	Kotagiri	Mean
1.	Abamectin	16.67	0.00	13.33	10.00
2.	Acephate	0.00	6.67	10.00	5.560
3.	Acetamiprid	0.00	23.33	56.67	26.67
4.	Chlorantraniliprole	86.67	90.00	83.33	86.67
5.	Chlorpyriphos	56.67	60.00	50.00	55.56
6.	Chlothianidin	23.33	13.33	26.67	21.11
7.	Cyantraniliprole	66.67	80.00	80.00	75.56
8.	Cypermethrin	40.00	0.00	23.33	21.11
9.	Dimethoate	50.00	40.00	0.00	30.00
10.	Emamectin benzoate	60.00	46.67	60.00	55.56
11.	Flonicamid	13.33	10.00	6.67	10.00
12.	Flubendiamide	40.00	0.00	26.67	22.22
13.	Imidacloprid	93.33	96.67	90.00	93.33
14.	Indoxacarb	6.67	6.67	3.33	5.56
15.	Lambda cyhalothrin	83.33	80.00	76.67	80.00
16.	Profenophos	33.33	33.33	23.33	30.00
17.	Spinitorum	53.33	63.33	50.00	55.56
18.	Thiamethoxam	43.33	0.00	36.67	26.67
19.	Thiodicarb	3.33	0.00	13.33	5.56

CONCLUSIONS

The results of the present study revealed the pesticide usage pattern in the carrot in The Nilgiris district. Insecticides like imidacloprid, Chlorantraniliprole, lambda cyhalothrin and cyantraniliprole were extensively used by the farmers to control carrot pests. Famer's knowledge on personal protection while spraying, source of information on pesticide, disposal of pesticide container was very less. Hence intervention of the government organizations *viz.*, Department of Horticulture, Krishi Vigyan Kendra and ICAR institutes is highly essential to educate the farmers on safe handling of pesticides, organic and natural farming systems to overcome food safety issues.

FUTURE SCOPE

Farmers are being advised to use appropriate, less-lasting pesticides and proper agricultural practises to manage carrot insect pests and diseases. In the future, supervised field trials for evaluating pesticide residues will be conducted to reduce consumer risk and pesticide persistence.

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Conflict of Interest. None.

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