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Distribution of insects pests and pesticide usage pattern on cucumber in Southern districts of Tamil Nadu

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Abstract
A detailed survey was conducted to understand the farmers behavior on pesticide use and usage pattern in cucumber from Southern districts of Tamil Nadu viz., Tirunelveli, Thoothukudi, Tenkasi, Kanyakumari during the year 2021-2022 who mostly depends on insecticides as its primary pest management tool in pest management. The socio-economic status of the targeted farmers revealed that 6 per cent of farmers belong to above 50 years age group and 30 per cent of farmers belong to 20 to 30 years age group and 54 per cent of farmers belong to 30 to 40 years age group and 10 per cent of the farmers belong to 40 to 50 years age group. Vegetable crops cultivated in polyhouse conditions are susceptible to pest attack because the conditions inside are ideal for the fast reproduction of pests. Cucumber mites, thrips, beetles, whiteflies, aphids and leaf miner were found to infest the crop among cucumber mites and leaf miner is the major pest. For the management of mites and other sucking pests, concerning the use of pesticides 20 different pesticides belongs to organophosphates, synthetic pyrethroids, neonicotinoids, spinosyns, avermectins and diamides groups were utilized, either alone or in various tank mix configurations. Power sprayers are the most common type of sprayer used in our study area. Pesticide dealers are an important source of information for farmers when it comes to pesticide recommendations (61.33%).

Keywords: Cucumber, survey, pest, pesticides, organophosphates, neonicotinoids

Introduction
Cucumber (*Cucumis sativus* L.) is a member of the Cucurbitaceae family. Asia and Africa are home to thirty species of *Cucumis*. Cucumbers are indigenous to the tropics and are one of the first domesticated vegetables. It has a broad medicinal value and is utilised extensively in Ayurveda, Siddha, and Chinese medicine. Cucumber is a profitable crop that is rich in carbohydrates, proteins, fibres, vitamins (primarily A, B1, B2, B6, C, D, and E), macro nutrients such as sodium, potassium, and calcium, and micronutrients such as copper, zinc, and iron (Changade and Ulemale, 2015).

Protected cultivation is practiced in more than 55 countries worldwide and the total area has grown to 6,23,302 hectares (Hickmann, 2011) [3]. In Asin, China has the largest area under protected cultivation (2.5 million ha^{-1}) under poly house /greenhouse. In India, the amount of land used for protected agriculture has doubled to 2 million acres (NAIP, 2014). According to Nair and Barche (2014) [5], Andhra Pradesh, Gujarat, Maharashtra, Haryana, Punjab, Tamil Nadu, and West Bengal are the states that continually increased the area under protected agriculture from 2007 to 2012. Maharashtra is leading state in India with 8000 hectares area under protected cultivation. In greenhouse, mostly carnation, gerbera, rose, tomato, cucumber and capsicum crops are cultivated. Karnataka is in second place with 1000 hectares of land under protection cultivation, followed by Himachal Pradesh with 700 hectares of land under protection agriculture. In 2013-14, India had a protected cultivation area of 45,000 hectares and an annual yield of 698 000 metric tonnes of cucumbers (Sanjeev *et al*., 2015) [7].

In recent years, neonicotinoid pesticides have been the fastest-growing category of insecticides used for crop protection. They inhibit the transmission of nerve impulses by interacting with insect nicotinic acetylcholine receptors (nAChRs) (Jeschke *et al*., 2011 and Watts, 2011). They have a systemic effect, travelling throughout the plant's tissues and defending every area of the crop. As neurotoxins with great toxicity to the majority of arthropods, they offer excellent control and have wide applications in agriculture and horticulture (Goulson, 2013) [2].

As the interior atmosphere is conducive to the fast reproduction of pests, polyhouse-grown vegetables are susceptible to a variety of insect pest infestations such as, Mites, *Tetranychus urticae* Koch; Whiteflies, *Trialeurodes vaporariorum* (Westwood), *Bemisia tabaci*

(Gennadius); Thrips, *Frankliniella occidentalis* (Pergande); Aphids, *Aphis gossypii* (Glover), *Myzus persicae* (Sulzer) (Averre and Gooding, 2004) [1].

Pesticide residues on agriculture and horticulture crops, during human consumption after pesticides have been used on them are becoming more and more important issue to find and measure. Maximum Residue Limits (MRLs) for pesticides in food have become very strict because more people are worried about the possible health risks of being exposed to pesticides (Hassanzadeh *et al*., 2010) [4].

Materials and Methods

A detailed survey was conducted in major cucumber cultivated areas in southern districts of Tamil Nadu *Viz*., Tirunelveli, Thoothukudi, Kanyakumari, and Tenkasi during the year 2021-2022.

Survey on insect pests and pesticide usage pattern in cucumber

As information pertaining to crop protection practices in cucumber was meagre, a detailed survey was carried out to collect data on different elements such as pests incidence, pest severity, type of pesticide used, dose, frequency, type of sprayer used, source of information and safety precautions taken during cucumber cultivation.

Details of study area

Major cucumber growing districts of Tamil Nadu *viz*., Tirunelveli, Tenkasi, Thoothukudi, Kanyakumari. Furthermore, blocks and villages were selected in each district based on information obtained from office of the Assistant Director of Horticulture located in respective districts.

Nature and source of data

The information on pest and pesticide use pattern in cucumber was collected from each district. A total of 50 farmers were questioned and information was gathered using an appropriate questionnaire. The survey was done in every district, block, and village is given in the (Table 1). Face-to-face interaction was carried out with individual farmers in a casual way and simple questions were asked to get the needed information. The questionnaire has 43 questions divided into three main category that includes the farmer details, crops grown, insect pests, the type of insecticides used, and the pesticide usage pattern. The purpose of the interaction and survey was clearly explained to the farmers so that they could give honest answers.

Mainly the questionnaire has three major parts.

Part 1: Basic information about the farmers (Name, age, education and family details)

Part 2: Information about production (Size of land area, crop data and previous crop grown)

Part 3: Details on the use of pesticides (Pest status, pesticides used, source of information, awareness about label information, pesticide details, dose, number of sprays, gap between sprays waiting period and safety precautions).

Results and Discussion

This article discusses the findings of a research done on the pesticide use trends of cucumber producers in four districts in southern Tamil Nadu. The obtained data on socioeconomic features, the package of practices implemented, the pest situation, pesticide use trends, and general knowledge of pesticide use were analysed in order to reach a conclusion.

Socio-economic characteristics of the farmers cultivating cucumber

In this particular research region, there were a total of 50 farmers who were questioned. 54.00 per cent of those farmers are in the middle age range of 30 to 40 years, and 10.00 percent of those farmers are in the age range of 40 to 50. (Table 2). When it comes to agricultural experience, 84.00 per cent of them have been doing it for less than five years, while the remaining 16.00 per cent of them have been doing it for from 5 and 10 years, and the majority of them are educated and inventive.

Information regarding cucumber cultivation

This area cultivates Dynamic++ F1, Momtaz F1, Devyani cucumbers for use as vegetables and salad ingredients. In addition to the vegetable variety, salad cucumbers grown in both polyhouse and open conditions are sent to the neighboring state of Kerala. Small and marginal farmers cultivate cucumbers and 90 percent of these farmers have less than 5 acres of land (Table 3).

Occurrence of insect pests in cucumber observed by farmers

According to the information that was obtained, the farmers' problems with insect pests suggested that the Red spider mite, *Tetranychus spp*. (83.33%) is common during the cropping season, but it is most severe in the summer in poly houses, as it is an issue that lasts throughout the whole year. (Table 4). Other insect pests observed includes, Aphids, *Myzus persicae* (40%), Thrips (*Frankliniella occidentalis*) (26.67%), leaf miner, *Liriomyza trifolii* (Burgess) (53.33%) and Cucumber beetles (*Acalyamma vittaatum*) (60%).

Pesticide usage pattern in cucumber

According to the findings of research conducted on the list of pesticides used for the purpose of pest control in cucumber crops cultivated in both polyhouse and open conditions, there were a total of 20 different pesticides belonging to organophosphates, synthetic pyrethroids, neonicotinoids, phenyl pyrazoles, spinosyns, tetronic acid derivatives, anthranilic diamides and avermectin groups. The insecticides used were in the order of Thiamethoxam (94%) > Imidacloprid (80%) > Acetamiprid (68%) > Cypermethrin (60%) > Spiromesifen (48%) > Dimethoate (44.00%) > Fipronil (44%) > Chlorantraniliprole (38%) > Flubendiamide (36%) > Chlorpyrifos (28.00%) > Deltamethrin (24.00%) > Profenophos (24.00%) > Triazophos (20%) > Acephate (20%) > Lambda- cyhalothrin (20%) > Permethrin (16%) > Emamectin benzoate (12%) > Monocrotophos (12%) > Abamectin (8%) > Spinosad (4%). For sucking pests like thrips and mites, they use imidacloprid, Spiromesifen, cypermethrin, thiamethoxam, acetamiprid, emamectin benzoate (Table 5).

General awareness on handling of pesticide in cucumber

The data pertaining to the farmers knowledge on the selection of pesticide for a target insect indicated that only 22 per cent of the farmers know the name of the pesticide suggested for the target pest and most (78%) of them are unfamiliar of the recommended pesticide (Table6). In the vegetative stage of

the crop for controlling mite infestation and beetle damages, 74 per cent of the farmers spray pesticides more than two times in a month. The situation is unchanged when the crop is in its reproductive phase and leaf mite is the primary pest. Approximately 68 per cent of farmers used pesticide and fungicide in combination. 92 percent of farmers utilized the bottle cap as a measurement device for insecticides, while others used an approximate quantity, resulting in an overdose or under dose (Table 9). The most frequent kind of sprayer is the power sprayer, and a spray man is used for pesticide application. When it comes to getting advice on plant protection, 68% of farmers consult with pesticide dealers, while 24% of farmers are in frequent communication with agricultural officers (Table 8).

In general, farmers who cultivate cucumbers have a poor understanding of how to safely handle pesticides and dispose of containers after they are no longer needed. Most people 78 per cent were unaware that they were being exposed to pesticides in their natural environments. Most of them 70 per cent throw their used pesticide containers out in the open, and 26 per cent of them use the containers at home or on their farms (Table 9).

Table 1: Details on farmers interviewed for pesticide usage pattern studies in Cucumber

District	Block	Village	No. of farmers contacted
Tirunelveli	Palayamkottai	Sengulam	2
	Nanguneri	Alangulam	4
		Marukalkurichi	3
		Munanjipatti	2
	Valliyoor	Kallikulam	1
Thoothukudi	Kayathar	Akilandapuram	4
		Kuruvinatham	2
	Srivaikuntam	Vitthalapuram	1
		Vallnadu	5
	Ottapidaram	Venkateswarapuram	3
Tenkasi	Kuruvikulam	Naduvapatti	1
	Kadayanallur	Krishnapuram	3
	Tenkasi	Rajapalyam	1
Kanyakumari	Boothapandi	Erachakulam	1
		Thuvaramkadu	3
	Agatheeswaram	Andarkulam	2
		Thoppur	1
	Karungal	Mathicode	5
	Thovalai	Erachakulam	2
	Thuckalay	Thuvaramkadu	1
		Kalkulam	3
	Total		50

Table 2: Socio-economic characteristics of the respondents (Cucumber)

S. No.	Particulars	Frequency(N=50)	Percentage (%)
1.	**Age (Years)**		
	20-30	15	30
	30-40	27	54
	40-50	5	10
	>50	3	6
2.	**Type of family**		
	Nuclear	47	94
	Joint	3	6
3.	**Gender**		
	Male	45	90
	Female	5	10
4.	**Farming experience (Years)**		
	< 5	42	84
	5-10	8	16

Table 3: Information regarding crop cultivation (Cucumber)

S. No.	Particulars	Frequency(N=50)	Percentage (%)
1.	Crop area (acres)		
	<5	48	96
	5-10	2	4
2.	Variety		
	Dynamic++ F1	30	60
	Momtaz F1	14	28
	Devyani	6	12
3.	Planting		
	Seeds	50	100

Table 4: List of key pests in Cucumber recognized by respondents

S. No.	Name of the pest	Frequency (N=50)	Percentage (%)
1.	Spider mite (*Tetranychus* spp.)	43	86
2.	Aphids (*Myzus persicae*)	15	30
3.	Cucumber beetles (*Acalymma vittatum*)	37	74
4.	Thrips (*Frankliniella occidentalis*)	19	38
5.	Leaf miner (*Liriomyza trifolii*)	27	54

Table 5: List of pesticide used for pest management in Cucumber in southern districts

Particulars				Frequency (N=50)	Percentage (%)
S. No.	Insecticides	Type of formulation	Trade name		
1.	Acephate	75SP	Asataf	10	20
2.	Acetamiprid	20SP	Manik	34	68
3.	Abamectin	1.9 EC	Quali-pro	4	8
4.	Cypermethrin	25 EC	Cyper, Superkiller	30	60
5.	Chlorpyrifos	20 EC	Lorsban	15	30
6.	Chlorantraniliprole	18.5 SC	Coragen	19	38
7.	Dimethoate	18.5 SC	Dimate	22	44.00
8.	Deltamethrin	25 EC	Delmetrin	13	26
9.	Emamectin benzoate	5SG	Proclaim	6	12
10.	Fipronil	5 SC	Blitz	22	44
11.	Flubendiamide	39.35 SC	Belt	18	36
12.	Imidacloprid	17.8SL	Confidor	40	80
13.	Lambda-cyhalothrin	2.5 EC	Karate	10	20
14.	Monocrotophos	36 SL	Monokill, Monostar	6	12
15.	Profenophos	50 EC	Curacron	12	24.00
16.	Permethrin	25 EC	Ambush	8	16.00
17.	Spinosad	45 SC	Tracer	2	4
18.	Spiromesifen	22.9 SC	Oberon	24	48
19.	Thiamethoxam	25WG	Actara	47	94
20.	Triazophos	40 EC	Rider, Protect	10	20

Table 6: General awareness on handling of pesticides in Cucumber crop

S. No.	Particulars	Frequency (N=50)	Percentage (%)
1	**Period of activity in using pesticides on cucumber crop**		
	<5 Years	39	76.00
	>5 Years	11	22
2	**Awareness on recommendations of pesticides**		
	With Awareness	11	22
	Without Awareness	39	78
3	**Farmers desire to mix different pesticides**		
	Insecticide + Insecticide	13	26.00
	Insecticide + Fungicide	34	68.00
	Fungicide + Fungicide	3	6
4	**Selection of spraying equipment**		
	Knapsack sprayer	7	14
	Power sprayer	43	86
5	**Time of pesticide application**		
	Morning or evening hours	48	96.00
	Day-night hours	2	4
6	**Precautions while application of pesticides**		
	Face mask	11	22
	Shirts with full hands	32	64
	No precaution	7	14
7	**Farmers perception of pesticide risk and occupational health hazards**		
	With perception	11	22
	Without perception	39	78

Table 7: Pesticide use pattern in cucumber

Districts	No. of sprays				Spraying interval (days)			
	7-10	(%)	10-15	(%)	10-15	(%)	5-7	(%)
Tirunelveli	5	10.00	9	18.00	7	14.00	13	26.00
Thoothukudi	3	6.00	7	14.00	3	6.00	3	6.00
Tenkasi	4	8.00	5	10.00	5	10.00	7	14.00
Kanyakumari	7	14.00	10	20.00	3	6.00	9	18.00

Table 8: Source on information on pesticide recommendation for management of cucumber pests

Particulars	Tirunelveli	Thoothukudi	Tenkasi	Kanyakumari	Total percentage
Department of Horticulture	3	2	1	2	16.00
KVK	4	-	4	3	22.00
Neighbour	-	-	2	4	12.00
Dealer	4	5	3	7	38.00
University	1	-	3	2	12.00

Table 9: Knowledge level of farmers on pesticide residues and disposal of pesticide container

S. No.	Particulars	Frequency (N=50)	Percentage (%)
1	Measurement of Pesticides		
	Bottle cap (Correct dosage)	46	92
	Approximately (More or less dosage)	4	8
2	Mixing of pesticides with water to prepare spray solution		
	Bare hands	0	0.00
	Stick	50	100
3	Disposal method followed for empty pesticide bottles		
	Used for house or farm purpose	13	26
	Sell	2	4
	Throw into trash	35	70

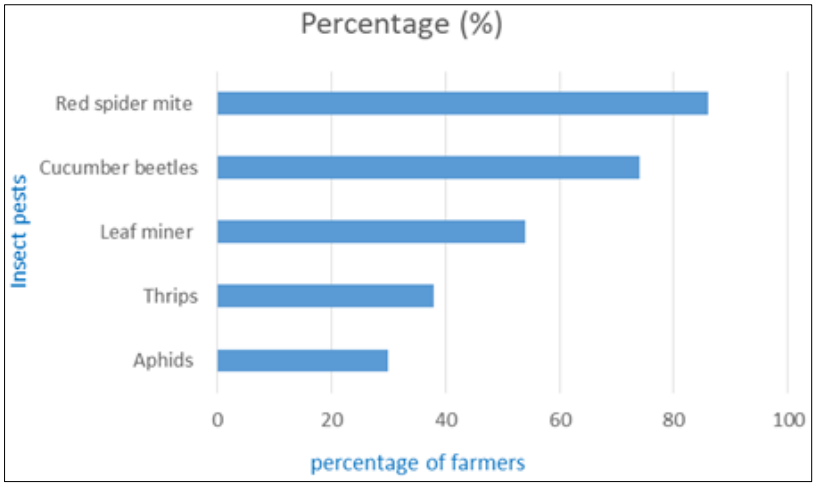

Fig 1: Key pests of farmers concern in Cucumber grown in Southern Districts

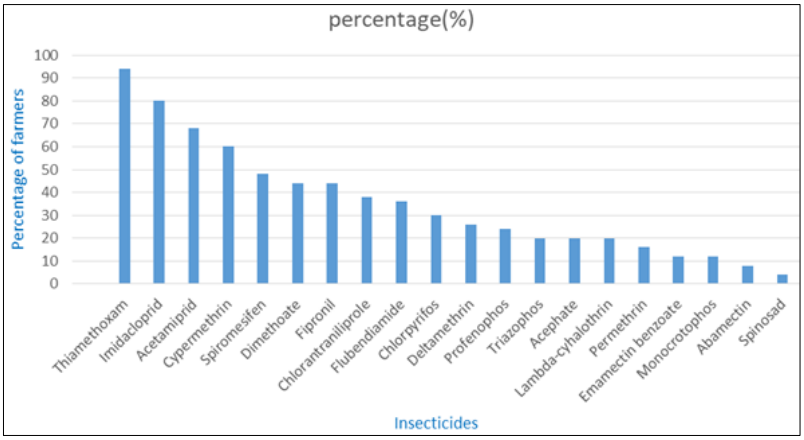

Fig 2: Pesticide used for pest management in Cucumber in southern districts

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