A REVIEW ON FREQUENCY AND PREVALENCE OF PYRETHROID POISONING IN INDIA

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Ms. Riya Raj C A

INTRODUCTION

Poisoning is one of the most ancient crimes among humanity and one that will never fade in society. The intentions of poisoning range from accidental, homicidal, to suicidal. The choice of poisons also differ across intentions of poisoning. For example, a suicidal poison choice would be an easily available, yet effective poison, whereas an accidental or homicidal poison may go unnoticed (less effective) for many days. Traditional pesticides are the organophosphates, organochlorines, and carbamates that are commonly used in pest management in the agro-business. A new and emerging class of pesticides are the pyrethroids which are of interest in forensic science due to its undue use in poisoning - both with suicidal and homicidal intent.

Pyrethroids are a synthetic version of pyrethrin, a naturally occurring pesticide found in chrysanthemum (flower). They were developed in such a way as to maximise their stability in the environment. It has insecticidal properties of pyrethrin that are strongly lipophilic and rapidly penetrate into insects, paralysing their nervous system.

In this background, some facts about pyrethroids are presented below: Chemistry of pyrethroids - Pyrethrins are a mixture of six structurally related insecticidal esters formed by a combination of two acids (chrysanthemic acid and pyrethric acid) and three alcohols (pyrethrolone, cinerolone, and jasmolone). The mode of action of pyrethroid poisoning - They act as axonic excitotoxins, i.e., the toxic effects are mediated by preventing the closure of the voltage-gated sodium channels in the axonal membranes. When the toxin keeps the channels in their

open state, the nerves cannot repolarize, leaving the axonal membrane permanently depolarized and thus paralysing the organism. This present study attempts to understand the frequency and prevalence of pyrethroid poisoning in India by understanding the production, sale, and number of poisoning cases reported during the period 2018-2021 in India.

RESEARCH GAP

A study to understand India-specific data with relation to production, sale, and poisoning occurring in India is missing. A study with such an objective can give a picture of the frequency and prevalence of pyrethroid poisoning in India.

OBJECTIVES OF THE STUDY

The study was performed with the following objectives

- To estimate the production capacity of pyrethroids in India
- To identify the sales of pyrethroids in India
- To identify the number of poisoning cases involving pyrethroids in India
- To estimate the number of fatalities involving pyrethroids in India

MATERIALS AND METHODS

The study took place during the period 2018-2021. The study adopted a meta-analysis cum data acquisition process. The information on production & import of pyrethroid pesticides was collected from published online sources. The data was collected from a comprehensive list of online portals that detail and list the production and import details of chemical pesticides in India. The details on sales of pyrethroid pesticides were collected from published online sources as well as information gathered from vendors. A comprehensive list of online stores which deal with pesticide sale as well

as market vendors were used to collate data on the sale of pyrethroid pesticides in India. The incidences of poisoning cases involving pyrethroid pesticides were collected from state crime records, medical hospital records, and indices from poison control centres (PCCs) across India. All PCCs were taken into consideration for this information.

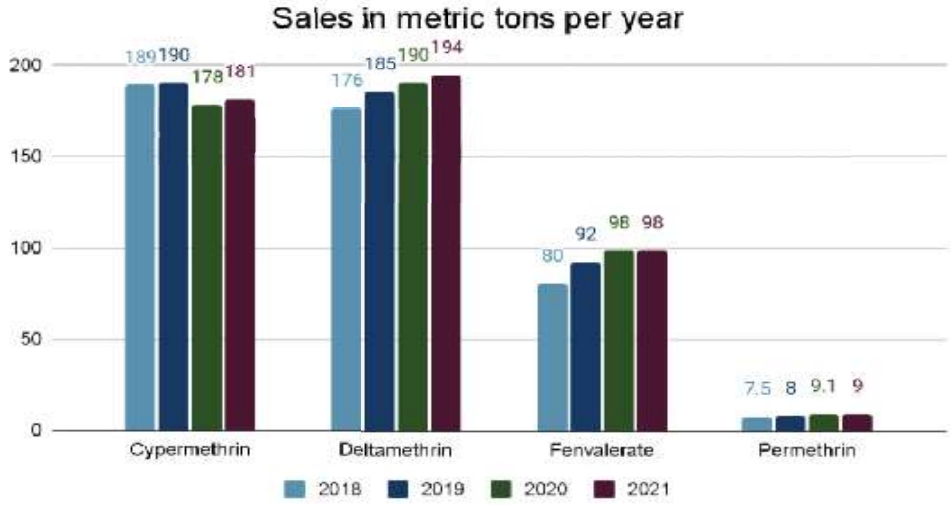
The details on fatalities by pyrethroid poisoning were collected from medical hospital records across India. Different databases were reviewed, and written communications were employed to collect this information. For the last 2 parameters, the region-wise zone was tabulated for comparison to ensure easy understanding of the data. For the purposes of this study, India was split into 6 regions.

FINDINGS AND ANALYSIS

Production of pyrethroids in India

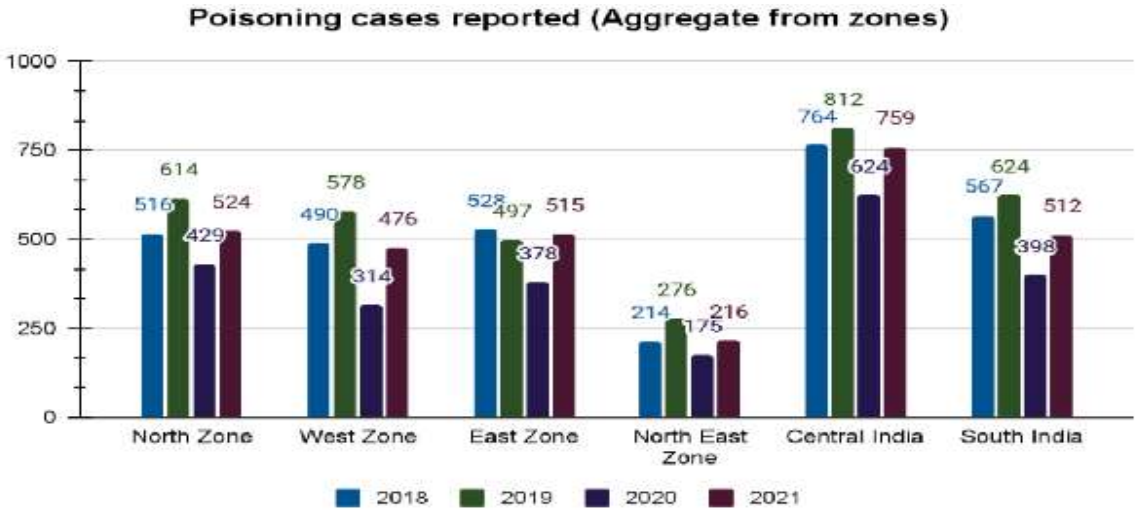
- Cypermethrin - The installed production capacity of cypermethrin across India was around 24 thousand metric tons in the fiscal year 2021. Since 2009, the general public has not been able to access the chemical.
- Deltamethrin - Mostly imported. 20 thousand metric tons were imported in 2018. The data of import since then is not available.
- Fenvalerate - 200 metric tons (2019)
- Permethrin - 1000 kilograms per year (as in 2019)

Sale in metric tons per year in India



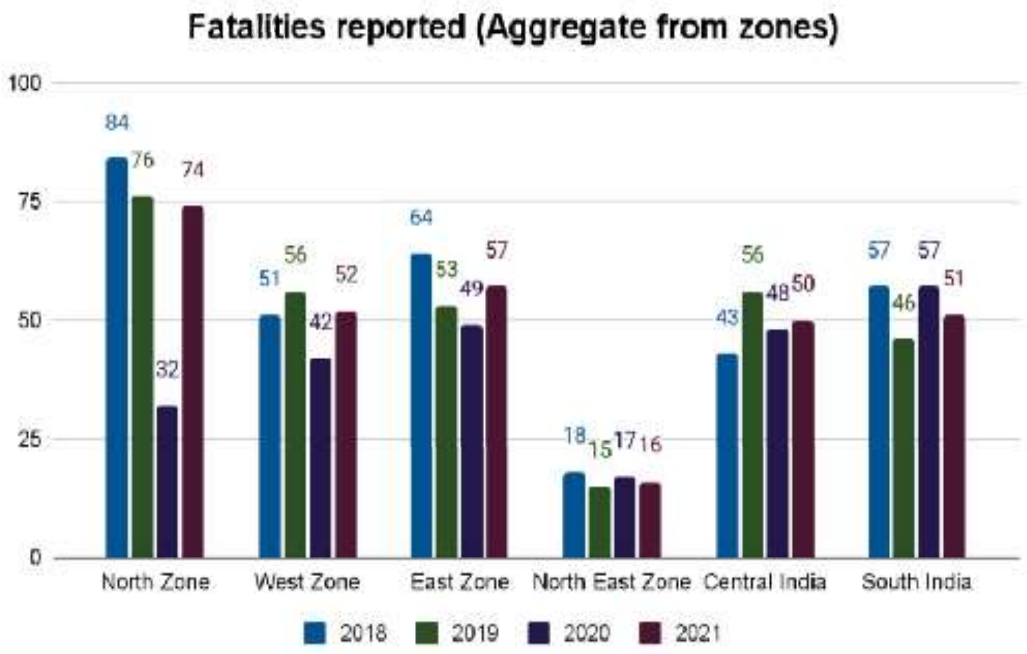
	2018	2019	2020	2021
Cypermethrin	189	190	178	181
Deltamethrin	176	185	190	194
Fenvalerate	80	92	98	98
Permethrin	7.5	8	9.1	9

Poisoning cases reported (zone-wise data) in India



	2018	2019	2020	2021
North Zone	516	614	429	524
West Zone	490	578	314	476
East Zone	528	497	378	515
North East Zone	214	276	175	216
Central India	764	812	624	759
South India	567	624	398	512

Fatalities reported (zone-wise data) in India



	2018	2019	2020	2021
North Zone	84	76	32	74
West Zone	51	56	42	52
East Zone	64	53	49	57
North East Zone	18	15	17	16
Central India	43	56	48	50
South India	57	46	57	51

CONCLUSION AND FUTURE SCOPE

The study shows a steady rise in the import, production, sales, and incidences of poisoning involving pyrethroid pesticides in India. The Covid pandemic served as a disruption to the study's findings. Therefore, the trend of production, sale, poisoning, and fatalities is not clearly presented due to the disruption. But it is safe to say that overall, there seems to be an increasing dependence by the farming community on pyrethroid pesticides. There is also an overall increase in poisoning and fatality cases involving pyrethroid pesticides in India.

The thought that pyrethroid pesticides only cause environmental pollution is no more true if this trend continues. Pyrethroids have

been thought of as environmental poisons, more than animal and human poisons in the past. Many studies have an environmental concern in their objectives. This preliminary study shows the impact of pyrethroid use and abuse among humans in India.

The trend is not clear due to the pandemic disruption in the period of study. But overall there seems to be an increase in the number of poisoning and fatalities of pyrethroids in India. This trend is indicative of the rise of pyrethroid pesticides as the new class of toxins - for both suicidal and homicidal purposes.

This study can further be strengthened by taking into consideration the number of suicidal poisonings, homicidal poisonings, and accidental poisonings. This can give an indication as to its abuse pattern. A more definite statistical study can provide insights as to whether the pattern is similar in other countries or if it is in India alone. This can give an indication of regional use/abuse.

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