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Status of Pesticide Use in India

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Globally more than half of the pesticides are utilized in Asia. India stands 12th in pesticide use globally and 3rd in Asia after China and Turkey. In present study, the data of different types of pesticides, pesticide use pattern and detailed pesticide consumption of the India and world were collected, organized and summarized. Around 70% of the total population is employed under agriculture sector which is the most important sector of Indian economy. And pesticides and fertilizers are major integral part of modern agriculture. Commonly used pesticides includes insecticides, fungicides and herbicides for management of uncontrolled weeds and pests on agricultural sites. However in total pesticide consumption, insecticides occupies highest share in India. India share only1% of the global pesticide use. As per the data of FAO, India has utilized around 58160 tonnes of pesticide in 2018. Per hectare application rate of pesticide was only 0.31 kg in 2017. While consumption in China, Japan and America was around 13.07, 11.76 and 3.57 kg ha^{-1} of pesticides, respectively.

Keywords: Indian Agriculture, Pesticides, Chemical Pesticides, Bio-Pesticides

Introduction

Pesticides are substances (natural or manmade) used to control pests, weeds, and diseases in plants in various agronomic practices. Herbicides, insecticides, fungicides, rodenticides, nematicides, and other pesticides are examples of pesticides. The losses of crops caused by insect pests are quite high in both developing and developed countries Dhaliwal et al. (2015). Reduced crop loss will be a key component, and enhanced pest management, including diseases and weeds, will require significant effort. Pesticides have become a key tool for plant protection and improvement of crops in the process of agricultural development. A. Sharma et al. (2019) . Pathogens and pests are causing global wheat losses ranging from 10% to 28%, rice losses ranging from 25% to 41%, maize losses ranging from 20% to 41%, potato losses ranging from 8% to 21%, and soybean losses ranging from 11% to 32%, according to a study published in the journal Nature, Ecology & Evolution. Savary et al. (2019). The intensity of protection for crops, as shown by a 15-20-fold increase in pesticides used around the world, has increased significantly in order to make agriculture more productive and profitable. Despite a clear increase in pesticide use, crop losses have not decreased significantly over the last 40 years.

Classification of pesticides

Pesticides are classified on the basis of various criteria such as toxicity (Hazardous effects), pest organism they kill and pesticide function, chemical composition, mode of entry, mode of action, how or when they work, formulations and sources of origin.

a. Classification of pesticides on the basis of toxicity: Toxicity of pesticide mainly depends on two factors namely dose and time. Hence, how much of the substance is involved

(dose) and how often the exposure to the substance occurs (time) give rise to two different types of toxicity- acute and chronic toxicity.

Class	Description	LD_{50} for the Rat (mg/kg Body Weight)			
		Oral		Dermal	
		Solids	Liquids	Solids	Liquids
Ia	Extremely hazardous	≤5	≤20	≤10	≤40
Ib	Highly hazardous	5–50	20–200	10–100	40–400
II	Moderately hazardous	50–500	200–2,000	100–1,000	400–4,000
III	Slightly hazardous	>500	>2,000	>1,000	>4,000

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Fig: Classification of pesticides on the basis of toxicity

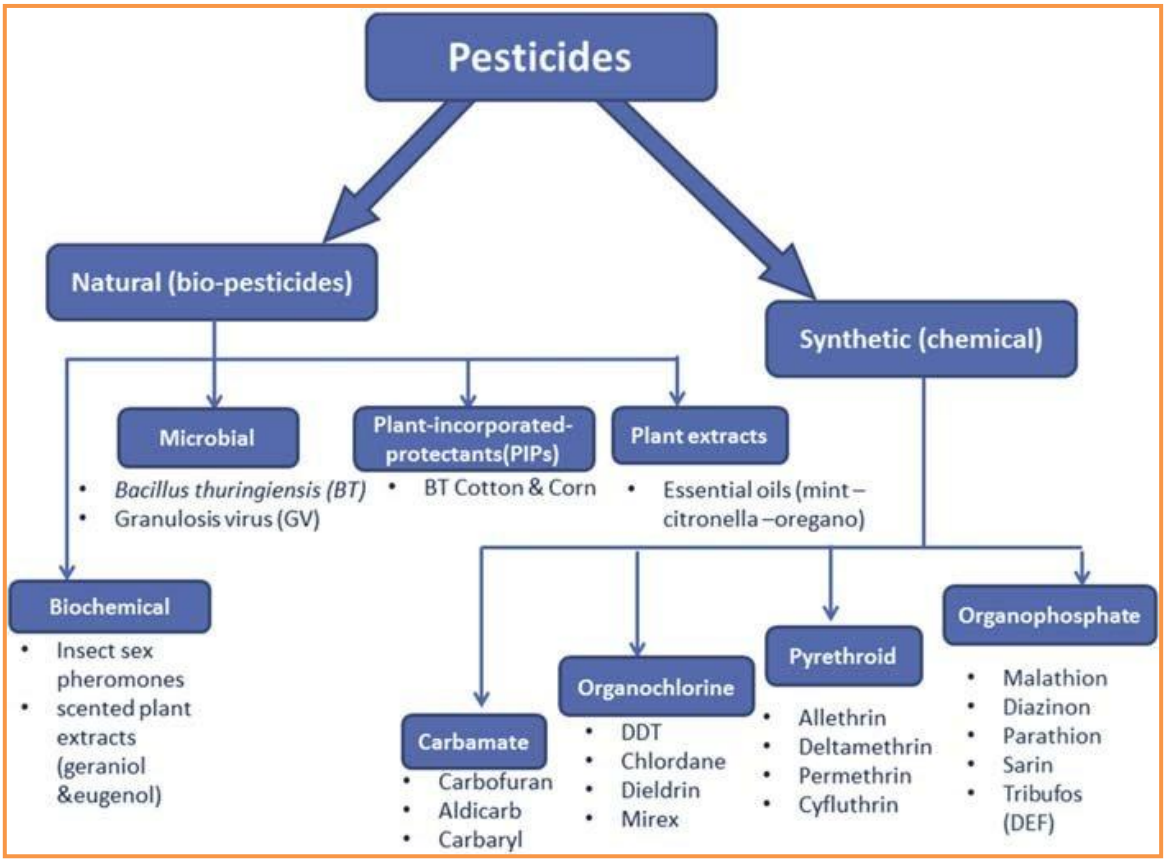

Fig: Classification of pesticides

b. Classification of Pesticides on the basis of Chemical Composition: This is the most common and useful method of classifying pesticide which is based on their chemical composition. Pesticides like insecticides, fungicides, herbicides and rodenticides are also classified on the basis of their chemical compositions as follows.

Insecticides: On the basis of chemical composition insecticides are classified as, Carbamates (Carbaryl), Organochlorine (Endosulfan), Organophosphorus (Monocrotophos), Pyrethroids (permethrin) Neonicotinoids (Imidacloprid), miscellaneous pesticides such as Spinosyns (Spinosad), Benzolureas (diflubenzuron), Antibiotics (abamectin), etc.

Fungicides: Fungicides are classified as aliphatic nitrogen fungicides (dodine), amide fungicides (carpropamid), aromatic fungicides (chlorothalonil), dicarboximide fungicides (famoxadone), dinitrophenol fungicides (dinocap) etc.
Herbicides: The herbicides are anilide herbicides (flufenacet), phenoxyacetic herbicides (2, 4-D), quaternary ammonium herbicides (Paraquat), chlorotriazine herbicides (atrazine), sulfonylurea herbicides (chlorimuron), etc.
Rodenticides : They are classified as inorganic rodenticides (Zinc phosphide, Aluminium Phosphide), coumarin rodenticides (organic) (bromadiolone, coumatetralyl)
c. Classification of Pesticides in the perspective of Forensic Medicine and Toxicology: Pesticides may be described as any physical, chemical or biological agent that will kill an undesirable or troublesome animal, plant or micro-organism. Pesticide is a generic name for a variety of agents that may be classified more specifically on the basis of pattern of use and organism killed.

Pesticides are classified as follows in textbook of Forensic Medicine and Toxicology.

1. **Insecticides** – Compounds which kill or repel insects and related species. e.g. Organophosphates, Organochlorine, Carbamates etc.
2. **Herbicides** – Compounds which kill weeds/ prevent growth of undesirable herbs or weeds in the field. e.g. parquet, atrazine etc.
3. **Fungicides** – Compounds which kill fungi and moulds. e. g. Captan, Captofol etc.
4. **Rodenticides** – Compounds which kill rats, mice, moles and other rodents. e.g. anticoagulants, arsenic, strychnine etc.
5. **Acaricides** – Compounds which kill mites, ticks and spiders. e. g. azobenzene, chlorobenezilate etc.
6. **Nematicides** – Compounds which kill nematodes. e.g. Ethylene bromide
7. **Molluscicides** – Compounds which kill the molluscs such as snails and slugs. e.g. Metaldehyde.
8. **Miscellaneous Pesticides** – Compounds of lead, Copper, Mercury, nicotine etc.

Discussion

Various classification of pesticides from different sources are reviewed in this article. These pesticides are used for different benefits such as for better yielding of crop production, protection of plants & preservation of food materials.

Conclusion

Farmers and the persons who are coming in contact with pesticides are unaware about types of pesticides and their hazardous effects. With the thorough knowledge of classification of pesticides, its gross use, exposure and toxicity can be minimized by using it judicially and it is helpful to public health & ecosystem.

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