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INTRODUCTION OF PESTICIDE AND ITS IMPACT

Rohit Bhargav

Himalaya Garhwal University, Uttarakhand

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Abstract:

Pest control agents are compounds known as pesticides. Herbicides, insecticides, nematicides, molluscicides, piscicides, avicides, rodenticides, bactericides, animal and insect repellents, microbicides, fungicides, and lampricides.

1. Introduction:

1.1 Pesticide:

Pest control agents are compounds known as pesticides. Herbicides, insecticides, nematicides, molluscicides, piscicides, avicides, rodenticides, bactericides, animal and insect repellents, microbicides, fungicides, and lampricides are included in this (*Randall C, et al.2014*, *Dunlop, Erin S.;2018*). Herbicides are the most widely used of them, making up around 50% of all pesticides used globally. The majority of pesticides are designed to act as crop protection agents, or plant protection products, which often shield plants from weeds, fungus, or insects. For instance, the aquatic weed Salvinia is controlled by the fungus Alternaria solani.

Target pests can include insects, plant pathogens, weeds, molluscs, birds, mammals, fish, nematodes (roundworms), and microbes that damage property, cause annoyance, spread disease, or are disease vectors. In general, a pesticide is a chemical (such as carbamate) or biological agent (such as a virus, bacterium, or fungus) that deters, incapacitates, kills, or otherwise discourage.

1.2 Types of Pesticide:

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Any substance or mixture of substances intended for preventing, destroying, or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals, causing harm during or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances that may be administered to animals for the control of insects, arachnids, or other pests in or on their bodies. The term includes substances intended for use as a plant growth regulator, defoliant, desiccant, or agent for thinning fruit or preventing the premature fall of fruit. Also used as substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.

Type of pesticide	Target pest group
Algicides or algaecides	Algae
Avicides	Birds
Bactericides	Bacteria
Fungicides	Fungi and oomycetes
Herbicides	Plant
Insecticides	Insects
Lampricides	Lampreys[3]
Miticides or acaricides	Mites
Molluscicides	Snails
Nematicides	Nematodes
Rodenticides	Rodents

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Slimicides	Algae, Bacteria, Fungi, and Slime molds
Virucides	Viruses

Based on their chemical compositions and the quantity used in a given situation, pesticides demonstrate their toxicity in biological systems. According to Garcia et al. (2012), pesticides are a large group of goods that also includes antiseptics, disinfectants, antibacterials, fungicides, algicides, rodenticides, and herbicides. Based on their physical and chemical characteristics, pesticides may be divided into two main groups. Depicts the classification of pesticides according to the kind of pesticide (synthetic or natural) and how it affects that bug. The bulk of synthetic pesticides were organic compounds and were divided into the following four categories: pyrethroids, carbamates, organophosphates, and organochlorines. Biopesticides, sometimes referred to as naturally occurring pesticides, are created by living organisms including fungi, bacteria, and plants (Abubakar et al., 2020; Bhatt et al., 2020a, 2021b).

1.3 IMPACT:

a) Impact of physical and chemical factors on the transformation of pesticides in soil and water:

Pesticide behavior and biological activity in soil are determined by their lightness, ionizability, lipophilicity, polarizability, and volatility (Bailey and White, 1970; Pignatello and Xing, 1995; Gevao et al., 2000; Beulke et al., 2004). In general, a pesticide's destiny in a soil ecosystem is influenced by both abiotic (related to its physicochemical features) and biotic (related to the existence of living organisms) transformations.

While chemical structures control the durability of pesticides in soil or the environment, physical characteristics make them robust and reduce losses. The mobility of chemical

compounds in soil and aquatic systems as well as their resilience in challenging environments are related to their physical and chemical characteristics (Pereira et al., 2016).

b) Pesticide impact on the natural system:

A third of all agricultural products worldwide are protected by pesticides, yet their widespread use has detrimental effects on ecosystems (Zhang et al., 2011). In 317 agricultural top soil samples from European nations, the distribution of 76 pesticide residues was assessed, the samples either contained one pesticide or more than one (Silva et al., 2019). On a variety of crop species, pesticides are applied excessively and indiscriminately, harming beneficial biota including microbes, honey bees, predators, birds, plants, and tiny animals.

Pesticides can harm and accumulate in areas other than crops as a result of poor management/mismanagement or a lack of information (misuse and overuse). Users do not properly follow label instructions and safety precautions such as donning rubber gloves and protecting eyewear from exposure (EPA Common cause of pesticide accidents) (Qu et al., 2019).

When compared to formerly used organochlorine pesticides, current use pesticides (CUPs) are more biodegradable in nature, as well as less harmful and persistent (Chen et al., 2020).

c) Pesticide impact on the soil system:

Bioaccumulation and toxicity are two issues.

As a result of this process, soils become secondary sources of pollutants in terms of air-soil interaction (Pokhrel et al., 2018). According to the paper, the distribution of 76

pesticide residues was examined in 317 agricultural top soil samples from European nations, which included one or more pesticides (Silva et al., 2019).

Pesticide bioavailability in the food chain, pesticide absorption, harmful kinetics, dispersion, metabolism, and excretion all affect species. Pesticides are applied excessively and indiscriminately on different crop types, harming beneficial biota such as microbes, honey bees, predators, birds, plants, and small animals (Alengebawy et al., 2021).

d) Pesticide impact on the aquatic system:

Persistence organic pesticides and CUP pesticides enter water bodies via a variety of mechanisms, including atmospheric precipitation, chemical or pesticide manufacturing industries discharging unprocessed chemical waste into running water sources (rivers) and other water bodies, where these pesticides travel for miles and contaminate aquatic or water bodies, negatively impacting aquatic ecosystems (Socorro et al., 2016). These chemicals aggregate and transfer from lower to higher trophic levels in aquatic systems, directly altering aquatic flora and fauna, and have an influence on human health through consumption or other methods (Woodrow et al., 2018). Chen et al. (2020) investigated the aquatic system of Shanghai, China, and discovered significant levels of CUP (napropamide, atrazine, and chlorpyriphos).

e) Effect of pesticide on water eco system:

The earth's surface covers around 71% of the water. Groundwater accounts for approximately 30% of the world's freshwater resources (Marsala et al., 2020). Because of rapid population increase, urbanisation, industry, agricultural pesticides, and population stress, groundwater quality is under threat (Jayaraj et al., 2016; Wagh et al., 2020). Over time, OCP exposure can cause cancer, birth defects, neurological impairment, reproductive issues, and immune system disorders (Agbeve et al., 2014; Fosu-Mensah et al.,

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2016). Pesticides that enter groundwater degrade its quality, making it dangerous for human consumption as well as for flora and fauna.

Pesticides that enter groundwater degrade its quality, making it dangerous for human consumption as well as for flora and fauna. Pesticide removal from groundwater is a difficult procedure. Pesticides in drinking water have detrimental effects on both people and ecosystems. Pesticide contact poisons around 1 million individuals, according to WHO (Hassaan and El Nemr, 2020).

f) Effects of pesticides on aquatic animals:

Pesticide exposure not only harms target species, but also a wide range of non-target organisms, with fish being the most noteworthy. In several cases, acute exposure to numerous pesticides resulted in fish death, whereas lower exposure to the same chemicals resulted in lethal changes. Changes in haematological parameters such as red blood cells, white blood cells, or plasma and serum level variations cause histological abnormalities affecting the liver, kidneys, gills, muscles, brain, and gut in many species of fish exposed to different pesticides (Tahir et al., 2021).

g) Hematological causes by pesticide in fish:

Haematological indicators are recognised as an important tool for assessing the state of the body's functioning in response to various stimuli (Ali and Rani, 2009).

Pesticides altered fish haematological parameters in a relatively short period of time (Rezania et al., 2018). As a consequence, the hematologic index may be used to easily monitor the health and response of fish and aquatic species to various toxicants, revealing the ecological position of the environment and a common method to identify the contaminant's sub-lethal impacts (Pimpao et al., 2007). Several genetic and environmental influences, according to Rios et al. (2002), affected the blood parameters of fish.

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h) Pesticide-induced behavioral changes in fish:

Pesticides can cause schooling behavior, mucus formation via skin's goblet cells (sliminess), motionlessness, changes in migration activities, tumbling towards base, jumping, non-responsiveness with hyperexcitability, irregular activities, increased opercular rate (respiration increases), and body colour changes in several fish species, including Tor putitora and Cyprinus carpio. Furthermore, they are capable of altering and disrupting aquatic vertebrate swimming behavior, such as that of fish and amphibians, as well as impairing their development rates (Stehle and Schulz, 2015). Pyrethroid exposure reduced the function of the dopamine active transporter, leading to erratic behaviour (Wang et al., 2020).

i) Malformations and reproductive disorders caused by pesticides in fish:

Pesticides may interfere with reproduction in brown trout (Salmo trutta) and Atlantic salmon (Salmo salar) (Jaensson et al., 2007). Furthermore, Dawar et al. (2016) observed a variety of developmental defects in fish exposed to the pesticide. Various studies have indicated that pyrethroids are hazardous to fish reproductive and early embryonic stages. Pyrethroids such as bifenthrin and permethrin may inhibit the development of egg proteins (choriogenin and vitellogenin) in young fish (Brander et al., 2012). Wu et al. (2020) found deltamethrin [second generation (type II) pyrethroid neurotoxic pesticide] to be harmful to the development of the swim bladder in zebrafish embryos at doses of 20 and 40 g/L.

j) Effect of chemical pesticides on plants:

Pesticides are used to improve agricultural yield (Tomer, 2013). The insecticide protects crops grown on agricultural land and reduces the danger of harm during post-harvest storage. It is highly powerful and beneficial in managing a number of illnesses in plants as

well as humans, such as malaria and typhoid, but it reduces the soil quality of agricultural land, which is why their negative consequences are kept in mind. Pesticides were prohibited or limited in most technologically sophisticated nations in 1960. A synthetic or chemical pesticide should ideally be harmful or fatal to the targeted or non-target species. Pests and insects will evolve resistance to modified pesticides as a result of widespread pesticide use.

Glyphosate was introduced by Brecke and Duke (1980) to minimise leaf dry matter buildup in Phaseolus vulgaris. L. Basantani et al. (2011) discovered that glyphosate (10 mm) exposure reduced the germination rate, dry weight, and root length of Vigna radiata. Mishra et al. discovered that spraying large amounts of pesticide (dimethoate) shortens root and shoot length. Dimethoate concentrations in the root are greater than in the shoot due to rising levels (Mishra et al., 2008). Murthy et al. (2005) investigated Glycin max L in a similar manner.

k) Effect of pesticides on vegetables and fruits:

Pesticides offer a barrier against pod infection by other pod-feeding insect pests, but damaged pods may not produce seeds or be of low quality, rendering them inappropriate for use (Mugo, 1998). Chitosan application at an early developmental stage increased plant growth and development and resulted in better seed yield in rice and soybeans (Chibu et al., 2002). Boonlertnirun et al. (2005) studied rice, and Rehim et al. (2009) studied maize and bean.

l) Pesticides impact on plant growth and metabolism:

Herbicides inhibit or control plant weeds through a range of biological mechanisms, including photosynthetic activity, mitotic cell division, enzyme function, root and leaf development, DNA and protein synthesis, cell membrane breakdown, and stimulating

uncontrolled growth. Pesticide use causes a variety of enzymatic and non-enzymatic changes in biochemical and physiological antioxidants, which can have an immediate effect on plant growth from germination and ultimately affect plant yield, such as vegetables, fruits, and seeds (Choudhury, 2019; Yengkokpam and Mazumder, 2020).

m) Effect of pesticides on plant defense systems:

The development of reactive oxygen species (ROS), which can eventually lead to growth deficit and lower photosynthesis efficiency in plants. Plants reduce pesticide toxicity by activating their antioxidative defence system, which includes non-enzymatic antioxidants and antioxidative enzymes (Xia et al., 2009; Sharma et al., 2015, 2017a,b, 2018b). Oxidative stress reduces plant proteins, chlorophyll pigments, and photosynthetic effectiveness (Xia et al., 2006).

n) Effect of pesticides on human health:

Long-term consumption of pesticide-contaminated soil and water increases the concentration of toxins inside the body organs and causes chronic diseases such as neurotoxicity, cancer, necrosis, asthma, reproductive disorder, cardiac disease, diabetes, and so on (Kalyabina et al., 2021).

Although quaternary nitrogen compounds like paraquat have been linked to neurodegenerative illnesses like Parkinson's, their molecular mechanisms are still unknown (Franco et al., 2010). Similarly, the carbamate pesticide group inhibits acetylcholinesterase (AChE) activity and is utilized as a biomarker of neurotoxicity (Gupta et al., 2016). The many pesticides are to blame for the cancer issue, but breast cancer is the most prevalent of all cancer kinds and is linked to organophosphorus (malathion and diazinon).

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Pesticides were extracted from breast milk samples obtained from 168 women at three different time periods using the fast, simple, cheap, effective, robust, and safe (QuEChERS) technique. DDT and its metabolites were discovered among the eight organochlorine pesticides tested in 447 breast milk samples during three sampling intervals. p,p′-DDE and p,p′-DDT were found in 100% of the breast milk samples, whereas p,p-DDD and o,p-DDT were found in 53.9% and 42.7% of the samples, respectively (Mekonen et al., 2021).

o) Effect of pesticides on plant physiology:

The reduction in total chlorophyll, as well as chlorophyll a, b, and carotenoid content, increases with increasing fungicide dosages applied to plant leaves (Tort and Turkyilmaz, 2003). According to Sharma et al. (2018a), herbicide application induces adverse consequences on plants such as necrosis, stunting, burns, chlorosis, and leaf bending. However, Donald (2004) discovered in his experiment that excessive pesticide treatment might result in a significant loss in structural vegetation variety. Most experts agree that pesticides have a negative impact on plant growth and development (Sharma et al., 2015, 2016 a, b, c).

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