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Pesticides and our environment

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Abstract

Pesticides include insecticides, rodenticides, herbicides, fungicides, and fumigants. Pesticides are used to kill the pests and insects which attack on crops and harm them. Pesticides benefit the crops however, they also impose a serious negative impact on the environment. Environmental impact of a pesticide depends on its dispersion in the environment and on its toxicological properties. Excessive use of pesticides may lead to the destruction of biodiversity. Many birds, aquatic organisms and animals are under the threat of harmful pesticides for their survival. Although pesticides are developed through very strict regulation processes to function with reasonable certainty and minimal impact on human health and the environment. Serious concerns have been raised about health risks resulting from occupational exposure and from residues in food and drinking water. Occupational exposure to pesticides often occurs in the case of agricultural workers in open fields and greenhouses, workers in the pesticide industry, and exterminators of house pests. Pesticide poisonings to wildlife may result from acute or chronic exposure. Additionally, pesticides may impact wildlife via secondary exposure or through indirect effects to the animal or its habitat. When people are exposed to pesticides they may feel dizzy, lightheaded, confused and may have reduced coordination and ability to think.

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Introduction

Pesticides are chemical compounds that are used to kill pests, including insects, rodents, fungi and unwanted plants (Isman *et al.*, 2011). Pesticides can contaminate soil, water, turf, and other vegetation (Maksymiv. 2015). In addition to killing insects or weeds, pesticides can be toxic to a host of other organisms including birds, fish, beneficial insects, and non-target plants (Aktar *et al.,* 2009). Although each pesticide is meant to kill a certain pest, a very large percentage of pesticides reach a destination other than their target (Sharma *et al.*, 2012). Pesticides easily contaminate the air, ground and water when they run off from fields, Pesticides are used in public health to kill vectors of disease, such as mosquitoes, and in agriculture, to kill pests that damage crops (Mahmoud *et al.*, 2016). There are more than 1000 pesticides used around the world to ensure food is not damaged or destroyed by pests, each pesticide has different properties and toxicological effects, many of the older, cheaper (off-patent) pesticides, such as dichlorodiphenyltrichloroethane (DDT) and lindane, can remain for years in soil and water (Hadian *et al.*, 2019). These chemicals have been banned by countries who signed the 2001 Stockholm Convention – an international treaty that aims to eliminate or restrict the production and use of persistent organic pollutants (Lallas., 2011). The toxicity of a pesticide depends on its function and other factors. For example, insecticides tend to be more toxic to humans than herbicides (Nicolopoulou-Stamati *et al.*, 2016).

The same chemical can have different effects at different doses, pesticides can also depend on the route by which the exposure occurs. (Nicolopoulou-Stamati *et al.*, 2016). Adverse effects from these pesticides occur only above a certain safe level of exposure. When people come into contact with large quantities of pesticide. This may cause acute poisoning or long-term health effects, including cancer and adverse effects on reproduction. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, because they are sprayed or spread across entire agricultural fields (Sande, *et al.*, 2011). Pests in the world today are destroying about 35% of all potential food crops before harvest. These losses are primarily due to insects, plant pathogens and weeds (Ghorab *et al.*, 2015).

In last few years various investigators proved that compounds which belong to Ops groups are dangerous on human life, owing to their toxic effects such as, mutagenic, teratogenic and carcinogenic effects. Drastically, it was found that Leukemia, Lymphoma and Parkinson's diseases are linked with OPs exposure (Alavanja *et al.*, 2009). The environmental pollution with pesticides is one of the most serious problems that facing the world due to their potential toxicity, high persistence and slow degradation. Currently, biotechnology is so concerned to achieve control on pesticide pollution. Soils with Organophosphates pesticide residues not only affect the non-target organisms but also lead to disequilibrium in the ecology of pesticide degrading microorganisms widespread use of pesticides in agriculture has experts worried due to their long-term environmental damage. Some pesticides can stick around for years, posing a very real threat to the ecological system and hence human health. Excessive and careless use of pesticides can contaminate water sources and soil, make fruits and vegetables less nutritious, and reduce biodiversity. Some pesticides have also been linked to the dramatic reduction in the number of bees across the world, posing a huge threat to agriculture and food security, given that bees pollinate more than 70% of all crops (Garbi *et al.*, 2006).

First warming signal about pesticides danger

In 1962, an American courageous woman and scientist, wrote down her nature observation and pointed out sudden dying of birds caused by in discriminated spraying of pesticides (DDT). Her book, Silent Spring, became a landmark. It changed the existing view on pesticides and has stimulated public concern on pesticides and their impact on health and the environment. Silent Spring facilitated the ban of the DDT in 1972 in the United States (Sitaramaraju *et al.,* 2014).

Soil contamination

Many of the chemicals used in pesticides are persistent soil contaminants, whose impact may

endure for decades and adversely affect soil conservation. Pesticides enter the soil via spray drift during foliage treatment, wash-off from treated foliage, release from granulates or from treated seeds in soil. Some pesticides such as soil fumigants and nematicides are applied directly into soil to control pests and plant diseases presented in soil. The transport, persistence or degradation of pesticides in soil depends on their chemical properties as well as physical. All these factors affect sorption/ desorption, volatilization, degradation, uptake by plants, run-off, and leaching of pesticides (Sitaramaraju *et al.,* 2014).

Ground water contamination

Pesticides, when sprayed on crop plants, are able to flow below the surface of the ground and reaching water-bearing aquifers, thereby contaminating groundwater. It is unsuitable that water for both human and agricultural uses (Agrawal *et al.,* 2010).

Food chain disruption

Pesticides come in contacts with water bodies, they can interfere with the food chain and cause disease in hidden ways. For example, if chemicals from pesticides such as lead or copper get into water bodies, fishes sometimes take them up. When humans eat such fishes (with contaminated waters), they can damage multiple systems in the human body. Kidney damage is one disease that can be caused by the consumption of contaminated water (Bro-Rasmussen, 1996).

Effect of pesticides on soil microorganisms

Pesticides may adversely affect the proliferation of beneficial soil microorganisms and their associated biotransformation in the soil. Inactivation of nitrogen-fixing and phosphorus solubilizing microorganisms is observed in pesticide-contaminated soils. Some pesticides disturb molecular interactions between plants and N-fixing rhizobacteria. Pesticides consequently inhibit the vital process of biological nitrogen fixation and reduce activities of soil enzymes that are key indicators of soil health. Pesticides may also influence many biochemical reactions such as mineralization of organic matter, nitrification, denitrification, ammonification, redox reactions and methanogenesis (Hussian *et al.,* 2009). Indiscriminate, long-term and over-application of pesticides have severe effects on soil ecology that may lead to alterations in or the erosion of beneficial or plant probiotic soil microflora. Weathered soils lose their ability to sustain enhanced production of crops/grains on the same land (Kalia *et al.*, 2011).

Impacts of pesticides on wildlife

The impacts of pesticides on wildlife are extensive, and expose animals in urban, suburban, and rural areas to unnecessary risks. Wildlife can be impacted by pesticides through their direct or indirect application, such as pesticide drift, secondary poisoning, runoff into local water bodies, or groundwater contamination. Pesticide exposure can be linked to cancer, endocrine disruption, reproductive effects, neurotoxicity, kidney and liver damage, birth defects, and developmental changes in a wide range of species. Exposure to pesticides can also alter an organism's behavior, impacting its ability to survive. In birds, for example, exposure to certain pesticides can impede singing ability, making it difficult to attract mates and reproduce. Pesticides can also affect birds' ability to care for offspring, causing their young to die. For bees, even "near-infinitesimal" levels of systemic pesticides result in sub lethal effects, impacting mobility, feeding behaviors, and navigation. Many deformations have been found after exposure to hormone-mimicking pesticides classified as endocrine disruptors. The impacts of these chemicals include hermaphroditic deformities in frogs, pseudo-hermaphrodite polar bears with penis-like stumps, panthers with atrophied testicles (Moriarty, 1972).

Pesticides are applied in many forms via various delivery methods to forests, rangeland aquatic habitats, farmland, rights-of-way, urban turf and gardens. Their widespread use makes contact with pesticide residues inevitable for some wildlife. Pesticide poisonings to wildlife may result from acute or chronic exposure. Additionally, pesticides may impact wildlife via secondary exposure or through indirect effects to the animal or its habitat exposure of wildlife over an extended period of time to pesticide

levels not immediately lethal may result in chronic poisoning (Chaturvedi *et al.*, 2013)

Wildlife includes plants, insects, fish, amphibians, reptiles, birds, mammals and many other animals. Pesticides applied in many forms to forests, rangeland, aquatic habitats, farmland, urban turf and gardens. Pesticides poisoning to wildlife may result from acute or chronic exposure, via secondary exposure or through indirect effects to the animal (Leen *et al.*, 2015).

Short exposure causes kill wildlife e.g. Fish kills caused by pesticide residues carried to ponds, streams or rivers by surface runoff or spray drift, bird die caused by foraging on pesticide treated vegetation, granules, baits, seeds or insects. These poisoning can be substantiated by analyzing tissues or by biochemical investigation processes. Exposure of wildlife over an extended period of time to pesticide levels not immediately lethal may result in chronic poisoning e.g. Bird mortality resulted from chronic exposure of organo chlorine insecticides on reproduction in certain birds of prey. (Chaturvedi *et al.*, 2013).

Effect of pesticides on human health

Pesticide residues are a public health concern and have been linked to a range of diseases and disorders Pesticides can cause topical reaction like blister, rashes, and respiratory discomfort. Chronic exposure can have much more serious effects including sterility, genetic changes, nerve disorders, asthma, depression, anxiety, hormonal imbalance, thyroid tumors, and reduced motor skills. Children and pregnant woman are especially vulnerable to the toxins in pesticides (Hutter *et al.*, 2018). Pesticides can cause, asthma, birth defects, neurological effects, cancer, Hormone disruptions in human. Pesticides can be potent neurotoxins. When people are exposed to neurotoxins they may feel dizzy, lightheaded, confused and may have reduced coordination and ability to think. These are the short term effects, while long term exposure can result in reduced IQ and learning disability, associated with permanent brain damage (Chaturvedi *et al.*, 2013).

Alternative to harmful chemical pesticides

For the average gardener, the use of organic pesticides can keep a healthy balance in the soil. Many organic pesticides are made of minerals or other plant materials that will keep pests at bay and break down quickly in the soil. Examples of some common organic pesticides include the following: Cayenne pepper spray can be sprayed on the leaves of plants to deter harmful insect. Soap Spray also sprayed on plants to get rid of aphids. Tobacco powder a spray can be made from the finely ground tobacco leaves and water. It is use to kill sucking insects on plants such as aphids, thrips and spider mites. Pyrethrin made from chrysanthemum plant. This organic pesticide is used to knock out and flying insects and ground pests such as grubs. Neem derived from the neem tree used to control Gypsy moths, leaf miners, mealy bugs, whiteflies and caterpillars. Sabadilla uerived from the sabadilla lily used to control caterpillars, leaf hoppers, stink bugs and squash bugs (Chaturvediv *et al.*, 2013).

Conclusion

For decades people have believed that harmful chemical pesticides were the only true way to rid gardens and crop fields from pests. Soil pollution, Air pollution has occurred from the use of pesticides and it takes years and sometimes decades for some of these chemicals to break down. These pesticides are also harmful to animal plants as well as human health. There are many environment friendly organic chemicals that are just as effective. The effects of pesticides on soil micro-organisms are less invasive when organic pesticides are used. People need to break the habit of using harmful pesticides and switch to rising organic ones that break down quickly in the sunlight and in the soil. The faster a chemical breaks down, the sooner the soil can return to a healthy state. Most organic pesticides are also safe to use around people and pets. They can easily be washed from fruits and vegetables making them healthier for us and our family to eat.

References

Agrawal A, Pandey RS, Sharma B. 2010. Water pollution with special reference to pesticide contamination in India. Journal of Water Resource and Protection **2,** 432.

Aktar W, Sengupta D, Chowdhury A. 2009. Impact of pesticides use in agriculture: their benefits and hazards. Interdisciplinary toxicology **2,** 1-12.

Alavanja MC. 2009. Introduction: Pesticides use and exposure, extensive worldwide. Reviews on environmental health **24,** 303-310.

Bro-Rasmussen F. 1996. Contamination by persistent chemicals in food chain and human health. Science of the Total Environment **188,** 45-60.

Chaturvedi M, Sharma C, Chaturvedi M. 2013. Effects of pesticides on human beings and farm animals: A case study. Research Journal of Chemical and Environmental Sciences **1,** 14-19.

Garbi C, Casasús L, Martinez-Álvarez R, Robla JI, Martín M. 2006. Biodegradation of oxadiazon by a soil isolated *Pseudomonas* fluorescens strain CG5: Implementation in an herbicide removal reactor and modelling. Water research **40,** 1217-1223.

Ghorab MA, Khalil MS. 2015. Toxicological effects of organophosphates pesticides. International Journal of Environmental Monitoring and Analysis **3,** 218.

Hadian Z, Eslamizad S, Yazdanpanah H. 2019. Pesticide Residues Analysis in Iranian Fruits and Vegetables by Gas Chromatography-Mass Spectrometry. Iranian Journal of Pharmaceutical Research **18,** 1.

Hussain S, Siddique T, Saleem M, Arshad M, Khalid A. 2009. Impact of pesticides on soil microbial diversity, enzymes, and biochemical reactions. Advances in agronomy **102,** 159-200.

Hutter HP, Moshammer H. 2018. Pesticides Are an Occupational and international journal environmental research and Public Health **15,** 2-3.

Isman MB, Miresmailli S, Machial C. 2011. Commercial opportunities for pesticides based on plant essential oils in agriculture, industry and consumer products. Phytochemistry Reviews **10,** 197-204.

Kalia A, Gosal SK. 2011. Effect of pesticide application on soil microorganisms. Archives of Agronomy and Soil Science **57,** 569-596.

Lallas PL. 2001. The Stockholm Convention on persistent organic pollutants. American Journal of International Law **95,** 692-708.

Leena L, Dilip S, Brahmadeep A. 2015 Dangers of Pesticides on Wildlife Ecology international journal of granthaalay **9,** 1-3.

Mahmood I, Imadi SR, Shazadi K, Gul A, Hakeem KR. 2016. Effects of pesticides on environment. In Plant, soil and microbes Springer Cham 253-269).

Maksymiv I. 2015. Pesticides: benefits and hazards. Journal of Vasyl Stefanyk Precarpathian National University **2,** 70-76.

Moriarty F. 1972. The effects of pesticides on wildlife: exposure and residues. Science of the total Environment **1,** 267-288.

Nicolopoulou-Stamati P, Maipas S, Kotampasi C, Stamatis P, Hens L. 2016. Chemical pesticides and human health: the urgent need for a new concept in agriculture. Frontiers in public health **4,** 148.

Sande D, Mullen J, Wetzstein M, Houston J. 2011. Environmental impacts from pesticide use: a case study of soil fumigation in Florida tomato production. International journal of environmental research and public health **8,** 4649-4661.

Sharma DR, Thapa RB, Manandhar HK, Shrestha SM, Pradhan SB. 2012. Use of pesticides in Nepal and impacts on human health and environment. Journal of Agriculture and Environment **13,** 67-74.

Sitaramaraju S, Prasad NVVSD, Reddy VC, Narayana E. 2014. Impact of pesticides used for crop production on the environment. Journal of Chemical and Pharmaceutical Sciences **3,** 75-79.