



Interactions of Pesticides with Environment and Environmentally Friendly Approaches against Agricultural Pests

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Abstract: In this review study, the relationship and effects of pesticides with human and environment have been examined. In addition to the rapidly growing population and urbanization, developing plant biotechnology for the production of agricultural products to meet the needs and an indispensable part of modern agriculture have become pesticides. Pesticides are being used extensively in the world in order to eliminate harmful substances in agricultural areas and to obtain quality products. As a result of unconscious pesticide use, human, air, water, soil and wild life are affected adversely, resistance is formed in target living beings, natural balance and natural balance are seen to be deteriorated by killing natural life and beneficial beings. Despite all the adversities brought by the pesticides, the use of different methods to combat the pests, the consciousness of the public on this issue and the increasing use of biopesticides which are very important are showing promising developments. It is also a very important development to see biopesticides begin to take up chemical pesticides in developed countries, especially in developing countries.

Keywords: Pesticide, Environmental, Biopesticides, Biotechnology

1. Introduction

Nowadays, the limited population of agricultural land to meet the increasing population and nutritional needs is one of the most important problem facing human beings. The increase in population, the establishment of new settlements, brought along the need for new roads as well as for industrial zones and therefore many agricultural areas have decreased in line with these needs. In this case, in order to meet the needs, increasing the quantity of products to be obtained from the unit area has become a primary priority. In addition to these negatives in agriculture areas, people have had to struggle with insects, diseases and many other problems that have caused significant damage in agriculture areas for hundreds of years. Among these methods of struggle, chemical control methods (namely pesticides) have an important place. The pesticide word is of Latin origin and means "disease-destroying".

The history of pesticides is based on ancient times and is still the most effective method today. Homer, about 1000

years before Jesus, speaks of sulfur fumigation. The first document on this subject belongs to Homer. Democraticus greases its leaves with olive extracts to prevent plant blight (B. C. 470). Before the year of Jesus, Cato used sulfur in his vineyards. The first substances used as pesticides are arsenic and sulfur. Later, botanical materials origin nicotine started to be used. Nicotine which is still very high risk in some regions, is also used for fishing [1].

The widespread use of pesticides in the war against insects began in the mid-1940s. The Swiss chemist Paul Mueller identified the pesticidal properties of dichlorodiphenyl trichloroethane namely DDT in 1939. DDT, which was introduced to the market in 1942, was rapidly spreading and the trend towards synthetic pesticides has increased. The rapidly increasing use of pesticides is divided into classes according to their different structures and purposes [1].

2. Classification of Pesticides

Pesticides are divided into classes with many

characteristics. A few of them are explained below.

Pesticides according to chemical structures; Organophosphates, N-methyl carbamates, Chlorinated hydrocarbons, Bisdithiocarbamates, Organotin, Botanicals, Arsenic, Phenoxyaliphatic acids, Piretrodler, Phenol derivatives.

Pesticides according to the organisms they influence; 1. Insecticides: Insect killers (ants, insects, caterpillars, cockroaches, mosquitoes etc.), 2. Herbicides: Herbicides (weeds, plants, mosses), 3. Fungicides: Fungicides (herbicides, other fungi, etc.), 4. Acaricides: Acaricides (carpets, carpet beetles, dust insects, etc.), 5. Rodenticides: Mouse killer, rodent killer, 6. Piscicide: Fish killers, 7. Avisitler: Bird Killer, 8. Molluscites: Molluscicides, 9. Nematocytes: Nematodes, non-segmented worms in the soil.

Pesticides according to their usage; 1. Agricultural use, 2. Non-agricultural use. In addition; 1. Public health 2. Structural, 3. Industrial, 4. Domestic, 5. Garden pesticides.

Significant progress has been observed in the agricultural production, the preservation of stored crops and forests as well as the control of vector insects that are infectious in humans as a result of intensive pesticide use in the struggle with harms. However, excessive use of pesticides has not been completely perfect and has brought many problems. The pesticides used cause both pesticides resistance to these drugs and the environmental balance by affecting beneficial insects, honey bees, birds, fish and people [2].

3. Effect of Pesticides on Nature and Living Organisms

Pesticides are transmitted to the environment as a result of

the construction or extensive use of the atmosphere, water, soil and pesticides [3, 4]. The usage of pesticides, their density, and the type of formulation, the weather conditions and the climate affect the spread of these chemicals in the environment. Especially, some of the sprayed pesticides are transported to the atmosphere with the reason of dispersion while the other part remains in plant and soil. The atmospheric pesticides return to the earth again with rain and snow. Pesticides, which accumulate more than necessary, adversely affect non-target plants and organisms in the long run. In addition to the morphological and anatomical differences that the pesticide applications bring to the plants, it also affects the bacteria, actinomycetes and fungi in the soil where the plant develops. As a result of the investigations, it has been found that more than 50% of the organic chlorinated pesticides can be in the soil for 15-16 years if applied to the soil [5]. In addition, the pesticides in the green parts of the plant can also reach the soil with irrigation and rain water. Thus, many microorganism groups that are beneficial for soil are also affected negatively from pesticides [6, 7, 8].

Miles and Harris [9] summarize how pesticides are infused into the water. Pesticides have been described as a direct pesticide application to plants living in the water and harmful insects, as well as the transfer of pesticides from pesticide applied plants to soil, subsoil water and also to water ecosystem and to the waters by rain from the atmosphere [3, 9].

The spread of pesticides in the environment affects both the environment and the ecosystem with people [10]. When applied to the soil, they can reach other levels of erosion, leakage, absorption and evaporation. As shown in Figure 1, pesticides can contaminate many environments [11, 12, 13].

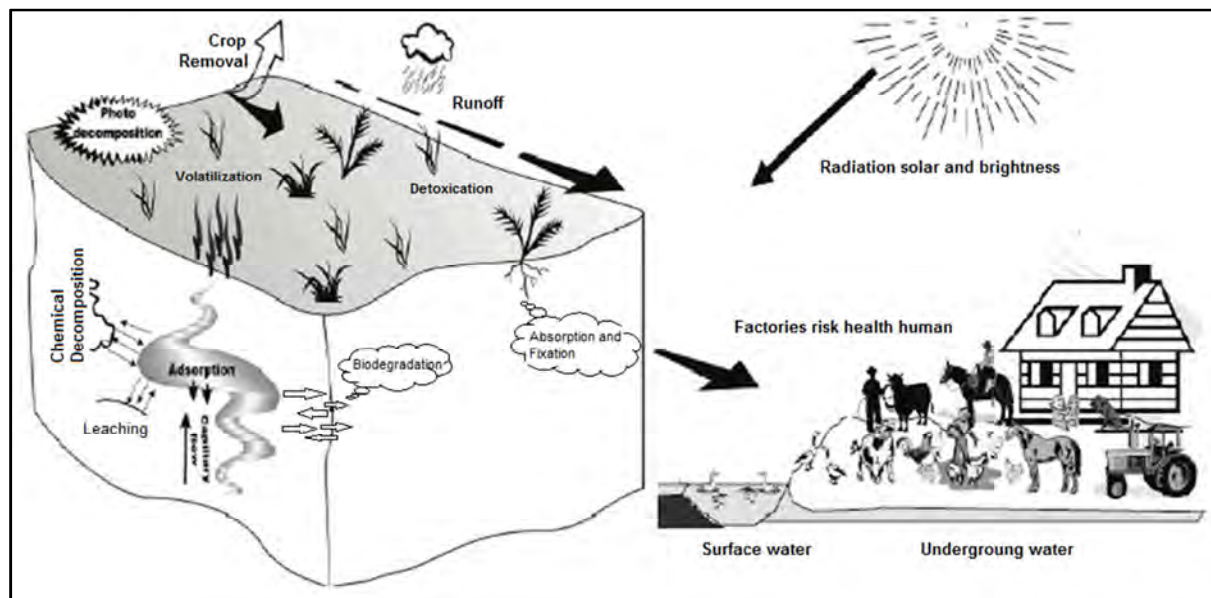


Figure 1. The effects of pesticides on soil and environment [13, 14, 15].

The ones most affected by pesticides; farmers, agriculture and other workers, structural insect control technicians (extruders), lawn and garden maintenance personnel. There

are quite a wide range of effects on the skin and respiratory tracts that affect the reproductive health [1, 16]. Pesticides that are affected by splashing and scattering can be removed

from the respiratory system and gastrointestinal tractus.

Pesticides have acute toxic effects on humans, either directly or indirectly. Many pesticides, including carbamates, organophosphates and chlorinated hydrocarbons, have genotoxic effects. In the people who deal with agricultural affairs, occupational influence is largely not through respiration, but through the skin, as it is thought. Even skin fumigants can be a way of absorption [1, 17]. In studies conducted in agriculture and pesticide exposure, structural and numerical chromosome anomalies and sister chromatid changes were observed in these individuals [18]. Bolognesi and Morasso [19] reported that 59% of the pesticides they use (synthetic pesticides) cause DNA mutation, 83% of chromosomal damage and 71% of them cause DNA damage. In addition, it was determined that 10% gave negative results in all tests. These and other studies have provided evidence that the gene mutation of pesticides is a potential chemical mutagen that triggers chromosomal DNA damage [20].

These chemical substances that can enter the human body through mouth, skin and respiration show different toxic effects against various life forms of humans and other living things. These general effects are; direct toxic effects, secondary toxic effects, reduction of food species, deterioration of living environment, change in the number of competing products and resistance to pesticides. It has also been identified in recent years that some pesticides have mutagenic, teratogenic and carcinogenic effects in humans, as well as chronic toxicity of residual pesticides [21]. The effects of pesticides on humans are not limited to adult individuals, but extend to fetal life [22]. As a result of the fetal passage of these chemical substances from placenta, abortion, hyperpigmentation and hyperkeratotic child births are seen. In animal experiments, it was observed that after 5 hours of administration of the radiolabeled drug, the drug was transferred to the placenta and the fetus was placed in the eye, nervous system and liver. [23, 24, 25].

4. Alternative Biotechnological Environmentally Friendly Approaches to Pesticides

Increasing days of human and environmental problems have made people aware of pesticides. As a result of increasing awareness of the harmful effects of pesticides, the trend towards natural pest control methods is accelerating. Among these, biological control methods are among the most remarkable. Biopesticides used in biological control methods often have no negative effect on the environment and human health, do not harm the food chain and do not leave toxic residues on the food. Biopesticides that are not harmful to nature and humans are certain types of pesticides derived from such natural materials as plants, animals, microorganisms, and certain minerals.

Microorganisms, bacteria, fungi and viruses have been used as insect fighting agents since the early 20th century. Today, microbial biopesticides are being produced from each

of these microorganisms and their use is becoming widespread. Although many insect pathogens are not known today, the use of *Bacillus thuringiensis* (Bt) products is much more common. In parallel with the developments in molecular biology and biotechnology, a number of studies have been conducted to increase the effectiveness of insecticidal microbial insecticides and to diversify their products [26, 27]. Bt was first isolated from the silkworm larvae that were sick in 1901 by the Japanese bacteriologist S. Ishiwata. E. Berliner made scientific identification of bacteria in Germany-1911. In 1916 Aoki and Chigasaki found that Bt had toxic activity due to a toxin in sports culture [22]. Due to its insecticidal properties Bt is used commercially for half a century of biological control. Bt-containing bio insecticides are widely used in the world against Diptera, Coleoptera and Lepidoptera. However, it has also been found that it has a lethal effect against invertebrates such as Hymenoptera, nematodes, protozoa, mite and flatworm [28, 29, 30]

5. Conclusion

The declining agricultural land and the decreasing agricultural production seem to be an important problem in the world. In the world, pesticides are used extensively in order to eliminate the harmful effects of agriculture and to obtain quality products. Pesticides used with the aim of obtaining quality products ensure the destruction of harmful substances. However, pesticides exterminate not only insect pests but also non-target creatures and useful insects [31, 32]. Even the lowest level of pesticide residues accumulates in the living organism. Therefore, the substances taken seriously affect human and animal health and the environment. Today, it is aimed that pesticides can be used in the most effective but most problematic way.

A better understanding of the environmental and human health hazards of pesticides widely used in the fight against harmful causes in agricultural areas has accelerated the search for effective and enough natural compounds that can be used instead of these drugs. In this context, biopesticides emerged as the most reliable and hopeful products. Biopesticides are known as low-toxicity, fast-degrading, non-mutagenic, selective-looking and non-deleterious substances in the ecosystem against non-target beneficial organisms [33]. The use of natural biopesticides known to be harmless should be widespread and more emphasis should be placed on the work in this area. Developing plant biotechnology is not alone in the long run to produce more products in high quality and unit area. For this reason, it is very important that the plant biotechnology and methods of struggle progress at the same level.

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