OVERVIEW

Assessing the impact of pesticides: An overview

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ABSTRACT

There are three types of pesticides. They are organochlorine, organophosphate and carbomate compounds. Organophosphorus compounds are remarkable for their selective toxicity, low persistence and greater biodegradability. Organophosphates are less lipophilic than chlorinated hydrocarbons. Because of the rapid biodegradability, the organophosphate insecticides have replaced more persistent organochlorine compounds and are used in greater quantity. India accounts for one third of pesticides poisoning case in the world. A majority of them get exposed for long periods cases of blindness, cancer, deformities, diseases of liver and nervous system etc., from pesticide poisoning have been identified. These pesticides however have a large scale of contamination in the ecosystem as a result of which they cause various effects on the biotic components of the environments besides the pests or targets species for which the chemical is applied. The pesticide across media indicates portals of entry into the existing food web. The basic principle of adsorption, distribution, metabolism and excretion all toxicology is equally important when assessing toxic effects of pesticides on animal life. Various animals have also been used as indicators to measure the extent of pesticide pollution of the environment. The present investigations are attention is given mostly to studies pesticide effects on animal life and the environments.

Keywords: Pesticides, Toxicity, Health hazards and animals.

INTRODUCTION

Pesticides are widely used in agricultural production to prevent or control pests, diseases, weeds and other plant pathogens in an effort or reduce yield losses and maintain high product quality (Abbasi and Krishnan, 1993). Pesticides are commonly used to protect animals from pests. However, it is important to remember that any pesticides should be considered an active poison. For sustainable agriculture and protection of the environment and human health, the importance of using the pesticides has assumed global importance subsequent to in 'Earth Summit' in 1992. Although pesticide are developed through very strict regulation processes to function with

reasonable certainty and animal 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. Pesticide uses has raised serious concern not only of potential effect on human health, but also about impact on wildlife and sensitive ecosystem (Kamrin, 1997).

The World Health Organization estimates that there are three million severe acute poisoning world wise each year and out of this, approximately 2,20,000 death are attributable pesticides, out of which, 1% of these death occurs in industrialized countries (Sataka *et al*., 1997). The pattern of pesticide usages in India is different from that of the world in general. In India 76% of the pesticides are used as insecticide, as against 44% globally. The use of herbicides and fungicides are correspondingly less. The main use of pesticides in India is for cotton crops 45%, followed by paddy field and wheat farming (Relyea and Dieck, 2008). The use of pesticides in tea and vegetable crops in India is not negligible. Moreover, repeated low dose application has caused large impact in the agro-ecosystems than single exposure (Yassi *et al.,* 2001; Manchini *et al.,* 2005).

At present, India is the largest producer of pesticides in Asia and ranks XIIth in the world for the use of pesticides with an annual production of 90, 000 tons (www.teri.res.in/peticide.htm). A vast majority of the population (56.7%) in India are engaged in agriculture and are therefore, exposed to the pesticides used (Gupta, 2004; Government of India, 2001). Pesticides that are being used in agriculture fields disseminate into the environment and come in human contact directly or indirectly. Human are exposed to pesticides that are found in the environmental by different routes of exposures like inhalation, ingestion and dermal contacts, keeping these in the backdrop among the farmers. Pesticides are chemicals that are meant to kill (Van der, 1996). The pesticides includes all of the following herbicide, insecticides, insect growth regular, nematicide, termiticide, molluscicide, piscicide, avicide, rodenticide, predacide, bactericide, insect repellent, animal repellent, antimicrobial, fungicide, disinfectant antimicrobial and sanitizer. The most common of these are herbicides which account for approximately 80% of all pesticide use (Carolyn Randall ed, 2013). Most pesticides are intended to serve as crop protection products, which in general protect plants from weeds, fungi or insects. Pesticide is a chemical or biological agent that deters, incapacitates, kills or otherwise discourages pests. Target pests can includes insects, plant pathogen, weeds, mollusks, birds, mammals, fish and microbes destroy property or disease vector and the environments are fully justified (Gilden *et al*. 2010; Tariq *et al.,* 2007).

The purpose of this present paper is to review of literature assessing the safety, impact of pesticides on human health and other animal life the environment effects.

HISTORY OF PESTICIDES:

The first known pesticide was elemental sulfur dusting used in ancient Sumer about 4500 years ago in ancient Mesopotamia. The Rig Veda, which is about 4000 years old, mentions the use of poisonous plants for pest control (Rao *et al.,* 2007). In the 17th century, nicotine sulfate was extracted from tobacco leaves for use as an insecticide. In 19th century saw the introduction of natural pesticides, which is derived from the roots of tropical vegetable (Miller, 2002). And first important synthetic organic pesticide DDT was discovered in 1939 by Swiss chemist Paul Muller. DDT was a very effective insecticide but they were replaced in the US by organophosphates and carbonates by 1975 (Ritter, 2009).

The U.S. Environmental Protection Agency was established in 1970 and amendment to the pesticide law in 1972 (US, EPA; 2011). Pesticides use has increased and 2.3 million tons of industrial pesticides are now used each years (Miller, 2002). The 75% of all pesticides in the world are used in developed countries, but use in developing countries is increasing. In recent years, chemical pesticides have become the most important consciously applied form of pest management. This is a generalization of course crops in same area. Pesticides are generally more water soluble and are often also more acute toxic. Pesticides effects on animal life such a fish, birds, reptiles, insects, mosquitoes etc., and which was a serious threat to biodiversity (Golden, 2007).

DEFINITION OF PESTICIDES:

Pesticides are unique among toxic substances. Most environmental toxins are an unwanted by product of

another process. Pesticides are chemicals designed to be harmful to a target pest and purposely introduced into the environment to do their job managing insects, bacteria, weeds, rodents or other pests (US, Envoi, 2007).

Pesticide means insecticides. Pesticide refers to not only insecticides but many other kinds of chemicals. Under state and federal law, a pesticide is any substance intended to control, destroy, repel or attract a pest (Kamrin, 1997; Goldman, 2007).

TYPES OF PESTICIDES

Pesticides are often referred to according to the type of pest they control. Pesticides can also be considered as either biodegradable pesticide. They will be broken down by microbes and other living beings led to its accumulation in the food chain and its killing of living animals of prey at the top of the food chain. Another way to think about pesticides is to consider those that are chemical pesticides or are derived from a common source or production method. Various pesticides were as given in the Table -1.

Organophosphate pesticides:
Organophosphates affect the nervous system by disrupting, acetyl cholinesterase activity, the enzyme that regulates acetylcholine, a neurotransmitter. Most organophosphates are insecticides. They were developed during the early 19th century, but their effect on insect, which are similar to their effects on human, were discovered in 1932. Some are very poisonous and they usually are not persistent in the environment.

Organochlorine insecticides:
They were commonly used in the past, but many have been removed from the market due to their health and the environmental effects and their persistence (DDT) chlordane and taxaphene.

Carbamate pesticides:
Carbamate pesticides affect the nervous system by disrupting an enzyme that regulates acetylcholine, a neurotransmitter. The enzyme effects are usually reversible. There are several subgroups within the carbamates.

Pyrethroid pesticides:
They are recently developed as a synthetic version of the naturally occurring pesticide pyrethrin, which is found in chrysanthemums. They have been modified to increase their stability in the environment. Some synthetic pyrethroids are toxic to the nervous system.

Table-1: Various types of the pesticides for Agriculture field use in safe concentration.

Sr. No.	Types of the Pesticides	Name of the Pesticides	Safe concentration of the pesticides in agriculture field
01	Organophosphate	Monocrotophos	0.04 to 0.06
		Dimethoate	0.001 to 0.003
		Choloropyriphos	0.001
		Dichlorovos (DDVP)	0.001
		Phosphamidon	0.003
		Phosalone	0.004
		Malathion	0.001
		Endrin	0.0001to 0.0002
02	Organochloride	Endosulfan-I	0.001
		Endosulfan-II	0.002
		DDT	0.001 (2 kg/ha)
03	Carbamate	Carbofuran	0.001- 0.009
		Carbosulfan	0.001
04	Synthetic pyrithroids	Permethrin	0.001- 0.003
		Cypermethrin	0.001-0.002

Fig -1: Indicates of the bottle contains pesticide potential.

Neonicotinoid pesticides:

Neonicotinoids are a class of neurons active insecticides chemically similar to nicotine. It is the mostly widely used insecticide in the world (Yamamoto, 1999). In the late 1990 neonicotinoids came under increasing scrutiny over their environmental impact and were linked in a range of studies to adverse ecological effects, including honey bee colony collapse disorder and loss of birds due to a reduction in insect population. In 2013, the European Union and a few non EU countries restricted the use of certain neonicotinoids pesticides (Cressey, 2013).

Herbicides:

It has been commercialized for weed control. Chlorsulfuron are broad spectrum herbicides that kill plants by inhibiting the enzyme acetoacetate synthase. In the 1960, more than 1 kg/hac (0.89 Ib/Acre) crop protection chemical was typically applied, while other herbicides sulfonylureas, sulfosulfuron, etc. allow as little as 1% as much material to achieve the same effect (Lamberth *et al.,* 2013).

Herbal pesticides (Bio pesticides):

It is also known as Bio pesticides. Herbal pesticides are certain types of pesticides derived from such natural materials as animals, plants, bacteria, fungus or viruses and minerals. Their use is controversial, especially in many European countries (Coombs, Amy, 2013).

The pesticide, Insecticides differently is not seen in term of their toxicity they are equally toxic. The pesticides are classified into four categories as indicated by their label, such as Red as indicates extremely poisonous, Yellow indicates poisonous, Green indicates moderately poisonous and Blue indicates low poisonously. It is naturally occurring substances that control pest and microbial diseases.

Have significance about potential pesticide exposure. Many pesticides under red label are banned now. Label of the pesticides are Red, Yellow, Green or Blue based on their order of decrease in poisonous effect to animals or plants (Fig-1).

USES OF PESTICIDES / INSECTICIDES:

These are useful for both agriculture and human purpose. Plant pesticides increase crop yield in agriculture by protecting plants. Pesticide use also controls spread of diseases by fungi, bacteria, insects from one region of farms to other region or even countries. It was seen that some pests which were not present came here due to import of wheat or other countries. So the insect or bacteria if controlled, diseases spread in between countries or places can be prevented. Pesticides used by the farmers are extremely hazardous, many are highly and few are slightly hazardous. The farmers also used some other products like ash, cow dung, oilcake, kerosene and lime dust, Neem leaves, Neem cakes, mixture of tobacco leaves and washing indicum etc., in their farm land. But the use of these products were in very less quantities as compared to their inorganic parts (Hoppin *et al*., 2002; Horrigan, *et al.,* 2002; Ecobichon, 2001).

POLLUTION OF PESTICIDES:

Pesticides and insecticides are some of the most toxic chemicals used in present world on regular basis. These are chemical agents used to kill pests or plants. The environmental effect of pesticides is a concern now. These pesticides are spread into air, water bodies like rivers, canals, soil due to their regular use in the form of spraying, powders, solutions in agriculture. In homes and garden when used as mosquito repellents, bed bug spray etc., in homes or regular basis enter into physiology of humans and animals on breathing. Those food grains grown in pesticide polluted soil enter the food chain of all the living animals. The pesticides entering water resources travel to other places spreading the pollution of these pesticides (Honsby *et al*., 1993; Paul, 2002).

IMPACTS OF PESTICIDE AND INSECTICIDE:

Pesticides use raises a number of environmental concerns. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, including non-target species, air, water and soil. Pesticide drift occurs when pesticides suspended in the air as particles are carried by wind to other areas, potentially contaminating them. Pesticides are one of the causes of water pollution and some pesticides are persistent organic pollutants and contribute to soil contamination. Biological magnification is the process were by these pesticides are more concentrated at each level of the food chain (Nwilene *et al*., 2008). Among marine animals, pesticides concentration are higher in carnivorous fishes, even more so in the fish eating birds and mammals at the top of the ecological pyramid (Castro peter and Michael, 2010). Global distillation is the process were by pesticides are transported from warmer to colder regions of the Earth, in particular the poles and mountain tops. Pesticides that evaporate into the atmosphere at relatively high temperature can be carried considerable distance by the wind to an area of lower temperature where they condense and are carried back to the ground in rain (Atreya, 2007). It is desirable that pesticides be degradable or at least quickly deactivated in the environment. Such loss of activity or toxicity of pesticides is due to both innate chemical properties of the compounds and environmental processes or condition. The presence of chemical structure often slows down degradation in an aerobic environment. Absorption to soil may retard pesticide movement but also may reduce bioavailability to microbial degraders (Sims and Cupples, 1999).

Pesticides toxicity has hazardous effects on plants, soil, human, birds and other animals. The effect is poisonous and many physiological changes (system) are affected by them. Due to pollution of soil, air and water these chemicals and pesticides get into the body. Pesticides toxicity can cause a variety of adverse health effects, ranging from simple irritation of the skin and eyes to more severe effects such as affecting the nervous system, mimicking hormones causing reproductive problems and also causing cancer (US, EPA, 2006). A 2007, systematic review found that most studies on lymphoma and leukemia showed positive associations with pesticide exposure (Bassil *et al.,* 2007). There is substantial evidence of associations between organophosphate insecticide exposures and neurobehavioral alterations. Limited evidence also exists for other negative outcomes from pesticides exposure including neurological, birth defects and fetal death (Mink *et al*., 2011).

The World Health Organization (WHO) UN environment program estimate that each year, three million workers in agriculture in the developing world experience severe poisoning from pesticides, about 18,000 of whom die, and 99% of pesticide related deaths occur in developing countries that account for only 25% of pesticide usages (Miller, 2004). According to one study, as many as 25 million workers in developing countries may suffer mild pesticide poisoning yearly. There are several pesticides carvers a side from agriculture that may also put individuals at risk of health effects (Jeyaratnam, 1990).

It is concluded that the previous literature, farmers experienced a variety of significance and symptoms related to pesticides. Among the world populations, the prevalence of signs and symptoms related to pesticide exposure was higher among the farmers involved in spraying. The higher percentage of some signs and symptoms among the sprayers could be due to their direct exposure to pesticides or due to previous exposure to pesticides. It can thus be suggested that due emphasis is required to be given on the adoption of protective measures among the farmers and all agricultural field of the global in general. Pesticides are developed to function with reasonable certainty and minimal risk to human health

and the environments. The overall optimization of pesticide handling strictly regulations and also considering the public concerns about pesticide residues in food and drinking water could contribute to reduction of the adverse effect of pesticide on human health and environment. The best way to minimize human toxicity and also prevent environmental pollution and effect by increased rate of degradation, one has to rely on natural pesticides

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REFERENCES

Abbasi SA, and Sujatha Krishnan (1993) The new Japanese pesticide acrtap (pandan)-is it as environ. Friendly as claimed. Global environmental perceptions,Vol. 2. Ashish Publ. House, India. pp 1-145.

Atreya K (2007) Pesticide use knowledge and practices: A gender differences in Nepal. Environ. Res. 104:305-311.

Bassil KL, Vakil C, Sanborn M, Cole Dc, Kaur JS and Kerr KJ (2007) Cancer health effects of pesticides: Systematic review. Can Fam Physician. 53(10): 704-711.

Carolyn Randall ed. (2013) Association of State Departments of Agriculture (http://www.nasda.org) research Foundation, Washington, DC. Ch.I.

Castro Peter and Michael E. Huber (2010) Marine Biology. 8th. New York: McGraw Hill Companise Inc.

Coombs Amy (2013) Fighting Microbes with Microbes. The Scientist. Retrieved.

Cressey D (2013) The about pesticides. Nature doi 10/1028.

Ecobichon DJ (2001) Pesticide use in developing countries. Toxicology. 160:27-33.

Gilden RC, Huffling K and Sattler B (2010) Pesticides and health risks. *J. Obstet Gynecol Neonatal Nurs*.39:103-110.

Goldman IR (2007) Managing pesticide chronic health risks: U.S. Policies. J. of agriculture. 12(1):67-75.

Government of India (2001) Tenth five year plan: 2002-2007. Planning Commission of India, New Delhi. Pp. 513-566.

Gupta PK (2004) Pesticides exposure: *Indian Science. Toxicology* 198:83-90.

Hamilton DD, Ambrus A, Dieterle R., Felsot A, Harris C, Petersen B, Racke K, Wong SS, Gonzalez R and Tanaka K (2004) Pesticide residues in food acute dietary exposure. *Pest Manag. Sci*. 60:311-339.

Hoppin JA, David M, Umbach S, London J, Michael CR, Alavanja DP And Sandier JA (2002) Chemical predictors of wheeze among farm pesticides applicators in the Agriculture Health Study. *AM J. Respir Crit. Care Med*. 165: 683-9.

Hornsby AG, Buttler TM and Brown RB (1993) water quality and the environment. Managing pesticides for crop production and water quality protection: Practical grower guides. *Agr. Ecosyst. Environ*. 46: 187-196.

Horrigan L, Lawrence RS.and Walker P (2002) How sustainable agriculture can address the environmental and human harms of industrial agriculture. Environ. Health Perspect. 110(5):445-456.

Jeyaratnam J (1990) Acute pesticide poisoning: a major global health problem. *World Health Stat* Q. 43:139-144.

Kamrin MA (1997) Pesticide Profiles: Toxicity, environmental impact and fate. CRC Press.

Lamberth C, Jeanmart S, Luksch T and Plant A (2013) Current Challenges and Trends in the Discovery of Agrochemicals. Science. 341(6147): 742-6.

Manchini F, Van Braggen AHC, JiGGins JLS. Ambatipudi AC and Murphy H (2005) Acute pesticide poisoning among female and male cotton growers in India. *Int. J. Occup. Environ. Health* 11:221-232.

Miller GT (2004) Sustaining the Earth, VIth edition. Thompson learning, Inc. Pacific Grove, California. Ch.IXth, PP 211-216.

Mink PJ. Mandel JS, Lundin JI and Sceurman BK (2011) Epidemiologic studies of glyphosate and non-cancer health outcomes: a review. *Regul. Toxicol. Pharmacol*. 61(2): 172-184.

Nwilene FF, Nwanze KF and Youdeowei A. (2008) Impact of integrated pest management on food and horticultural crops in Africa. *Entomol.Exp. Appl.* 128:355-365.

Paul CJM., Ball VE, Fethoven RG, Grube A.and Nehring RF (2002) Effective costs and chemical use in United States Agricultureal production: using the environment as a free input. *Am. J. Agr. Econ*. 29:223-235.

Rao GV, Rupela OP, Rao VR and Reddy YV (2007) Role of biopesticides in crop orotection: present status and future prospects. *Indian J. of plant protection*. 35(1):1-9.

Relyea RW and Diecks N (2008) An unforeseen chain of events: lethal effects of pesticides on frogs at sublethal concentrations. *Ecol. Appl*. 18 (7):1728-1742.

Ritter SR (2009)Pinpointing Trends in Pesticides Use in 1939

Sataka MY, Mido MS, Sethi SA, Iqbal HY and Taguchi S (1997) Environmental toxicology. Discovery Publishing House, New Delhi, India. Pp. 185-197.

Sims GK and Sommer AM (1999) Factors controlling degradation of pesticides in soil. Pesticide Science. 55:598-601.

Tariq MI, Afzal S, Hussain I and Sultana N (2007) Pesticides exposure in Pakistan: A review. *Environ. Int*. 33:1107-1122.

US Environmental (2007): What is a pesticide?

US EPA (2014) Epa.gov. Retrieved.

Van der Werf HMG (1996) Assessing the impact of pesticides on the environment. *Agr. Ecosyst. Environ*. 60:81-96.

WHO (2010) International Code of Conduct on the Distribution and Use of Pesticides: Guidelines for the Registration of Pesticides. World Health Organization; Rome, Italy: 2010.

Yamamoto, Izuru (1999) Nicotine to Nicotinoids: Casida. John. Nicotinoid Insecticides and the Nicotinic Acetylcholine Receptor, Tokyo: *Springer- Verlag*. Pp.3-27.

Yassi YA, Kjellstrom T, Kok TK and Gudotli TL (2001) Basic Environmental Health, World Organization, Oxford University Press. 5:135-141.

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