Effect of Pesticide Application on Aquatic Environments and Fish Diversity in Indian Scenario

N. Sangeeta Rani
Assistant Professor of Zoology
Government Degree College for Women, Karimnagar.

Abstract

Study of the Effect of pesticide application on aquatic environments and fish diversity plays an emerging nee in Indian scenario. This study provide opinions of the latest clinical findings on health results and preference valuation of health dangers associated with insecticides and the position of benefit-value analysis in regulations associated with insecticides. Aquatic animals and aquatic sources are precious herbal belongings. Better productivity and protein yield as is offered by aquatic animals as compared to agriculture or animal husbandry and have much less power expenditure for food manufacturing. Besides protein, fish flesh consists of sufficient quantity of vitamins and minerals, which are vital for the boom. Agrochemicals publicity durations and levels, kinds of agro- chemicals used (regarding toxicity and endurance), and diverse environmental circumstance of the areas are also factors for acute and chronic poisoning on the aquatic animal as well as human fitness and environment.

Key words: Effect of pesticide application, aquatic environments, fish diversity, productivity and protein yield

Introduction:

Fisheries and aquatic resources (ponds, lakes, rivers, streams, and oceans) are exceptionally valuable natural assets enjoyed by millions of Americans. They provide citizens with generous long-term benefits in return for minimal care and protection. These benefits can be direct financial ones that provide employment, profit, and dollar savings. For example, the seafood industry provides jobs for commercial fishers, wholesalers, and retailers. More indirect, but equally valuable, benefits of fish and aquatic ecosystems include recreational boating, sport fishing, swimming, relaxation, and natural beauty.

Appreciation of fisheries and aquatic systems has been accompanied by increasing concern about the effects of growing human populations and human activity on aquatic life and water quality. Pesticides are one group of toxic compounds linked to human use that have a profound effect on aquatic life and water quality.

Effect of Pesticides on fresh water fish:

The contamination of surface **waters** by **insecticides** is known to have ill **effects** on the growth, survival and reproduction of aquatic animals. Different concentrations of **insecticides** are present in many types of waste **water** and numerous studies have found them to be toxic to aquatic organisms, especially **fish** species.

Chemicals of many types have long been known to be very toxic to fish, and authorities responsible for the control of pollution in rivers have recognised certain types, such as ammonia, phenols, cyanide, and the salts of some metals, as particularly dangerous to fisheries. Before 1940, most chemicals used as pesticides were based on these same toxic groups, in such compounds as lead arsenate, copper sulphate, sodium arsenite, sodium cyanide and phenolic mixtures. In addition to these, naturally- occurring organic compounds derived from plants, such as pyrethrum, derris and nicotine, were widely used as insecticides.

Pesticides are categorized into various types according to their objective use. Mainly pesticides are categorized into the three major types are herbicides (used for weed control), insecticides (used for insect control), and fungicides (use for mycotic control), but in comparison to all three types, insecticides are the more and acute toxic. Fishes species are the imperative wellsprings of proteins and lipids for humans and domestic animals, so the health of fish species is very essential for human beings. Insecticides are the synthetic compounds used to control various types of insects by killing or preventing them from engaging in undesirable behaviours or destructive.

Surface water contaminated by pesticides is notorious to impact on the aquatic and terrestrial ecosystem, the toxicant traveling from the lithosphere, hydrosphere and atmosphere shown in the The survival and reproduction of the aquatic organism along with various advantages, of pesticides are threatening for the lasting survival of major ecosystems by interruption of ecological relationships between aquatic organisms and loss of biodiversity. Different types of pesticides used are organophosphate, carbamates, organ chlorine, pyrethroids, and nicotinoids. The residues of the pesticides used for intensive agriculture practices can contaminate the water (surface runoff and surface drainage) generally within a few weeks after the appliance. Use of insecticides results in a decrease in the rate of growth and also causes many metabolic and reproductive disorders. Especially in fish species, it may cause histopathological changes in gills, liver, hematopoietic tissue such as the spleen, kidney, and renal tubules, in endocrine tissues as well as brain, neurological, behavioural disorder and also cause genetic defect on exposure to insecticides.

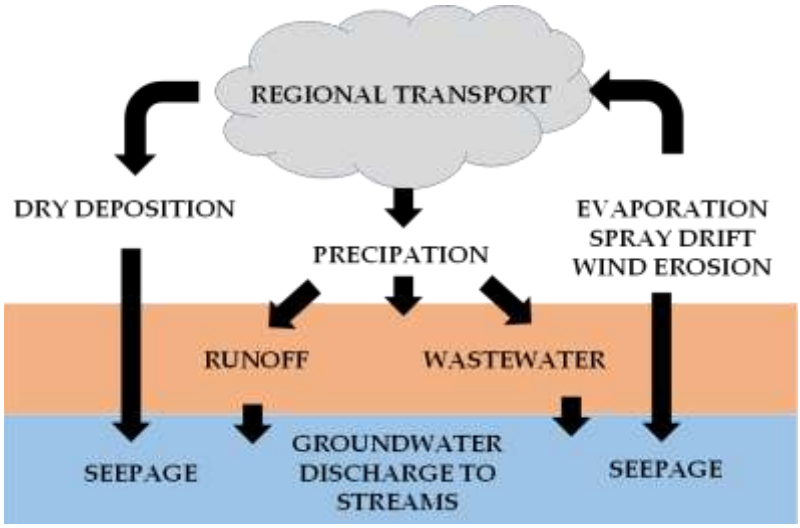

Figure 1.1. *Transportation of pesticides through atmospheric rotation.*

Aquatic and fisheries resources:

Aquatic and fisheries resources in the form of lake, reservoir, ponds, rivers, seas, and oceans are supplying human with long term reimbursement. Those benefits can be the form of financial support which can provide employment, profit, water requirement, etc. to the humans. For example, the aquaculture and seafood industries provide jobs for commercial fisheries, wholesalers, and retailers. More round about, but equally important, benefits of fish and aquatic ecosystems include recreational activities like boating, sport fishing, swimming and natural beauty.

Aquatic toxicology:

Aquatic toxicology is the study of the effects of environmental contaminants on aquatic organ- isms, such as the effect of pesticides on the health of fish or other aquatic organisms.

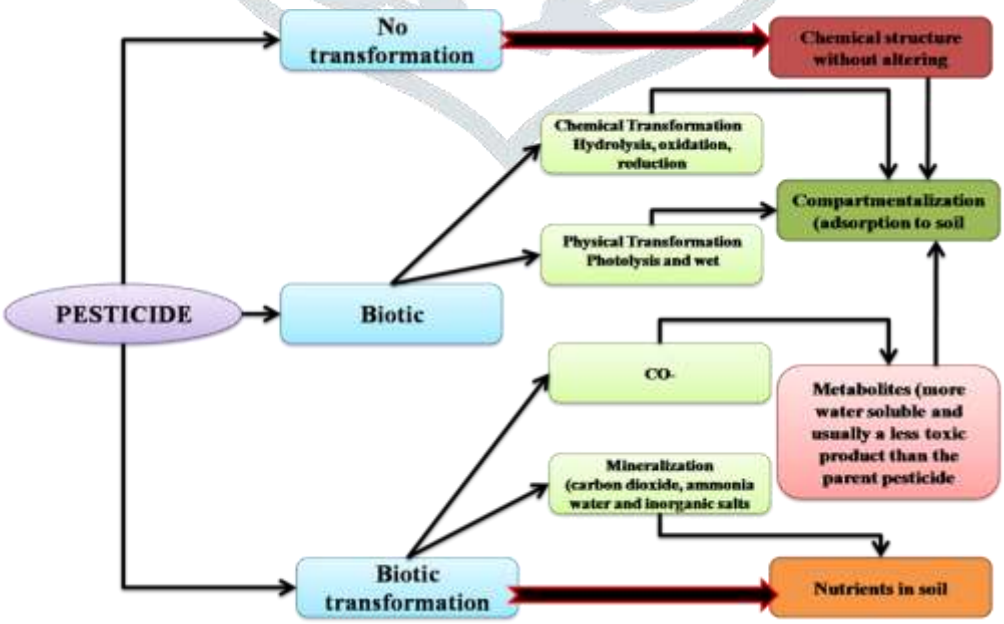

Figure 1.2. *Different route of exposure of pesticides in aquatic system (Adopted from Maurya and Malik 2016b).*

The pesticide's capacity to accelerate the harmful effect of fish and aquatic animals are large. It toxicity always depend upon exposure time, dose rate, persistence time in the environment. Toxicity of the pesticide refers to how poisonous it is. Brief exposure to some chemicals may have little effect on fish, whereas longer exposure may cause harm (Arbuekal and Server, 1998; Barone *et al*., 2000). Bio-concentration is the accumulation of pesticides in animal tissue at stages more than the ones in the water or soil to which they have been carried out. The poisonous substance inters into the aquatic animal body and effected on the idea of attention of toxicant. The sediment and soil are ecologically important for aquatic habitat, which plays a significant role in nutrients hooding capacity. Highly polluted sediments or accumulation of nutrients are adversely affecting the ecological functioning of rivers due to persistence in the environment and longrange transport. Repeated exposure to certain insecticides can result in decreased fish egg production and hatching, nest and brood abandonment, decrease resistance to disease, reduced body weight, hormonal modifications, and reduced avoidance of predators.

Types of contaminants in fish species:

These types of contaminants in fish species can cause various health issues to unsuspecting consumers, mainly in pregnant or nursing women. The rule and regulations, as well as international oversight for the aquaculture industries, are very complex, in which various agencies indulge in aquaculture practices follow these regulation i.e. selection of site, control over pollution, quality of water, feed and also the safety of food. Different types of agricultural practices used insecticides results estrogenic and anti-estrogenic contaminants in the ecosystem can cause endocrine disruption and also effect on fish reproduction rate. Application of insecticides used for control a wide variety of insectivorous which would otherwise diminish both the quantity and quality of food production. Desolately, in spite of various advantages, the synthesized chemical compounds have significant drawbacks also threaten the long-lasting survival of major environmental disorder in relations between the aquatic organisms and also the loss of biodiversity.

Costs and benefits of pesticide use:

The profitable analyses of pesticide remuneration are hindered by the lack of pesticide use data and fiscal models for minor and crops as well as non-agricultural pesticides. Cost–benefit analysis of pesticides use is increasingly used to measure resource supervision and environmental policies. This approach monetizes all costs as well as benefits so that they are deliberate in currencies and its full functioning might be constrained by data limitations factor and difficulties in monetizing human and environmental health risks. Further economic impacts are complicated by the various government programmes that support pesticide users, such as price and cost supports system and deficit payments.

The most usually economic incentives are based on the "polluter pays" principle, including the use of licensing fees, user fees or taxes. Denmark, Sweden, and Norway are some of the countries which experience the introduced taxes in such a way of reducing pesticide use. However, the price elasticity of this chemical is estimated very low and can suggest comparatively very little effect in terms of quantity reductions, unless they may set very high rates relative to price. Some suggestions in regard to pesticides are to revenue and recycling may have been more effectual, with revenues redirected to research and information. Using further research or to encourage various changes in farming activities would appear to make more sense (Pearce and Koundouri, 2003).

Various steps to reduce the effect of pesticides: Before using any pesticide, think about the following:

- Only use the pesticide whenever necessary.
- Use another ways of treating the predicament. Landowners should think about the expenses and consequences of pesticide cure relative to the problem.
- Use pesticides having less toxicity.

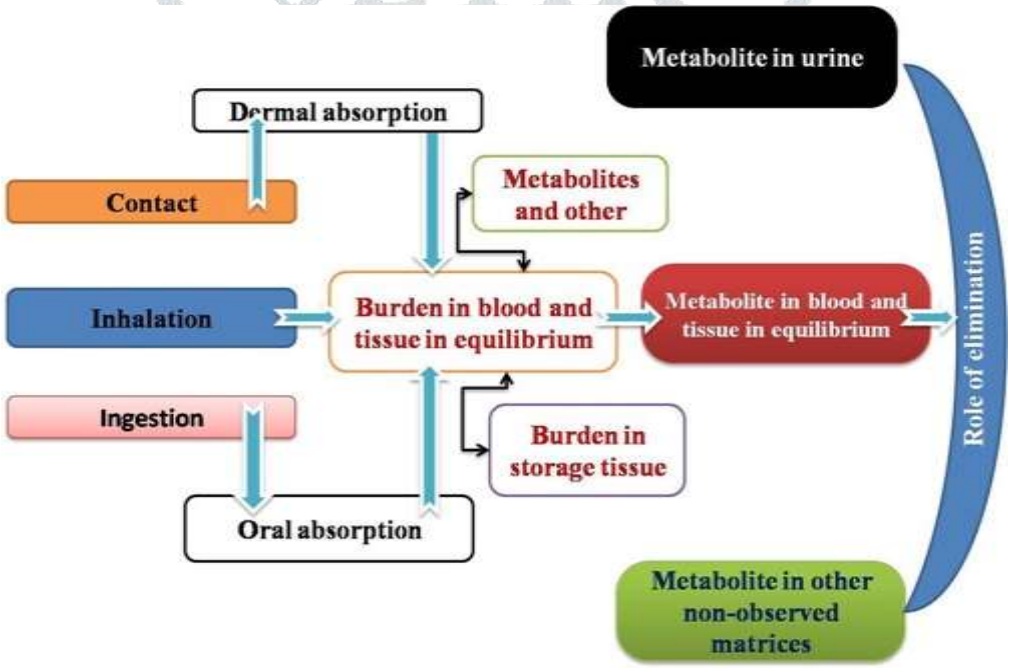

Figure 1.3. *Distribution toxicant by route of exposure in the animal body and representation of the toxic kinetic model (Source: Maurya and Malik, 2016a).*

Key Impact factors:

1. To reduce the sound effects of pesticides on aquatic ecosystems, use only those least toxic pesticides to the aquatic organism. Some relative toxicity lists of pesticides used in various agricultural activities are presented in tables at the end of this booklet.
2. The initial tenet of accountable in the use of pesticide is to understand and then go through the pesticide

label and follow the guidelines precisely. Label information sometimes can be mystifying. Contact extension agent, supplier in a case if don't recognize the directions or the company of pesticide for more information.

3. Give meticulous awareness to the word of warning about ecological hazards on the sticky label. Look the label to confirm that: "These manufactured goods are toxic to fish species." think about supplementary pesticide or any other alternative control technique.
4. Certify that equipment is working in fine proviso. Check for any leakage, reinstate worn out parts, and vigilantly standardize your equipment.
5. While preparing the pesticides for relevance, subsist that you are assimilation them accurately.
6. Never rinse spray tools in lakes, ponds, or rivers. If you use water directly from the natural ponds, lakes, or streams, use an anti-siphon device to avoid backflow.
7. In some case applying pesticides near surface water, ensure the sticky label to locate the suggested buffer zone. Buffer strip widths varied between the water and the treatment areas. Depart a broad buffer zone to shun contaminating fish species and aquatic flora and fauna.
8. Store up and dispose of unused pesticides and their containers according to the label directions.
9. Avoid the use of pesticide waft into no target areas, or applications for the period of wet, turbulent weather that may endorse runoff to non-target streams, ponds, or lakes. Mist on cool days or in the early hours or evening when it is less windy.
10. Pesticide applicators are legally responsible for downstream fish mortality and pesticide contamination.

Challenges of the global pesticide market:

Fast increase in globalization is affecting pest management practices on and off the farm. The decline in the trade barriers also increases the competitive pressures and provides extra incentives for farmers to reduce costs and increase crop yields. Former participation and input markets, often branded as successful marketplace reform, can lead to incompetent pesticide use and high external costs (FAO, 2009). Other types of forms of trade barriers create a disincentive for adopting new technology such as the unwillingness of the EU to accept (GMO) genetically modified organisms. It may be imperative to indicate that it is not only the big multinational that are an important group of parties in pesticide policy but also the many new based companies in the developing countries who manufacture generics. An increases trend in the agrichemical industries is the big movement of many chemical pesticides off patent. As a result of these chemicals become generic pesticides, manufacturers lose their monopolies on them. Overall, generic type companies make up about 30 % of total sales. Mounting sales of generic pesticides, especially in some countries not only in Africa and Latin America but also in some of the Asian countries, is often facilitated by weak authoritarian control and the lack of an IPM oriented national policy framework (FAO, 2009). Around 30 to 35% of pesticides marketed in the developing countries with an estimated market value of USD 900

million manually do not get together internationally accepted quality standards. They preteens a serious threat to human health and also on their associated environment. Such types of pesticides often put into the accumulation of outdated pesticide stocks in developing countries (FAO, 2009).

Efficient supervision practices for the protective quality of water:

1. Preferred only IPM practices in order to avoid the chemical controls methods or will be applied only whenever necessary. Preventive measures should be taken before using any pesticide and can be applied safely and in an effective manner.
2. Estimate the concentrations of chemical control in agricultural practices. Separate out the major option that is the slightest adverse impact on water quality. Select those products which reduce waste and applicator exposure.
3. Proper care should while incorporation and loading pesticides. Check equipment working correctly and is properly calibrated in advance. Prepare only the required amount of pesticide needed for the urgent application.
4. Apply pesticides in short and precise time period. Think about climate as well as the life cycle of pest before planning applications.
5. Store pesticides products safely in a ventilated away from sunlight, and protected area free from flooding.
6. Disposal of empty containers of pesticides should not rinse in water.
7. Keep records about the concentration and timing of all pesticide used in the area. This will help in assessment of pest control efforts and also help to plan future treatments.

Conclusion:

Exposure of aquatic as well as terrestrial organisms to pesticides for the long term means an incessant health risk for the inhabitants. So, directly and indirectly, human populace is at elevated risk by consuming the toxicities fish species. This clearly reveals that the individual should take the required preventative measure in the application of pesticides to guard the fish population and also to other aquatic fauna.

Thus it is probable that many approaches using according to molecular biology techniques will modernize toxicological applications that are cheaper and do not entail the animals to identify ecological stressors. Different effect of pesticide toxicity in fish species has been premeditated by a number of researchers, who have revealed that at chronic level, may cause different effects i.e. oxidative damage, the reticence of AchE movement, changes in histopathological, embryonic and developmental changes, carcinogenicity and mutagenesis.

Usage of pesticide and its undesirable effects on non-target aquatic organisms including fish species, it has befallen crucial to plan rigid rules and regulations against the arbitrary use of this pesticide.

Since pesticide in the environment have some other toxicant compound i.e. compounds of organophosphate, additive responses to organophosphate compounds may bring on poisonous or lethal effects in fish species.

Therefore it is an issue of enormous public healthiness consequence to habitually supervise the concentration of pesticide residues in foods material and also supervise the humans in a way to measure the resident's exposure to the pesticide. More experimental effort should be performed to establish the concentration and exposure time of these pesticides and also induce significant lethal and sub-lethal effects on the organism.

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