

A REVIEW STUDY ON NATURAL PESTICIDES & ITS USES IN PEST MANAGEMENT

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DOI: 10.5958/2249-877X.2021.00111.9

ABSTRACT

Natural pesticides are pesticides made by organisms usually for their own defense, or are derived from a natural source such as plant, animal, bacteria, and certain mineral, use to control pest naturally with less effect or no effect. Examples of these natural pesticides are Rotenone (Derris sp.), carboxin, fluroacetate, nicotine, neem (Azadiractaindica), microbial pesticide Bacillus thuringiensis, and pyrethrins. Natural pesticides usually target specific sites in the insect such as nervous system, resulting in knock-down, lack of coordination, paralysis and death. Nicotine inhibits and compete with neurotransmitter by binding to acetylcholine receptors at the nerve synapses and causing uncontrolled nerve discharge. This paper focuses on new types of bio pesticides, examine the specificity to harmful pests, and the selectivity to beneficial animals. Many of the modern pesticides used today, persist in soil for years and compound the store of toxins in the soil, air and water. Botanical pesticides are generally highly bio-degradable, and they become inactive within hours or a few days and can easily be broken down by stomach acids in mammals, so toxicity to humans and animals is very low to non-target organisms and are ecofriendly. Since they are also very effective, natural pesticides should be the first choice for pest management, which in turn reduces the bioavailability of metal and noxious effect in the environment.

KEYWORDS: *Bio pesticides, Natural Pesticides, Nicotine, Pest Management, Toxicity.*

1. INTRODUCTION

During the past three decades, efforts have been made to reduce the exposure and human risk of pesticides, especially insecticides. There is great demand for selective and safe insecticides that spare natural enemies and non-target organisms. Some conventional pesticides have been replaced by newer bio-rational (Bio pesticides) or "low risk" pesticides. Natural pesticides are pesticides that are made by other organisms usually for their own defense, or are derived from a natural source such as plant, animal, bacteria, and certain mineral.

Pesticide exposure and human risk have been reduced over the last three decades, with an emphasis on insecticides. Selective and safe pesticides that don't harm natural adversaries or non-target species are in high demand. Newer bio-rational (Bio pesticides) or "low risk" insecticides have replaced certain traditional pesticides. Natural pesticides are pesticides produced by other species for their own defense, or pesticides obtained from natural sources such as plants, animals, microorganisms, and minerals. As a consequence of run-off, about 80% of

pesticides sprayed penetrate different natural resources, exposing animals, farmers, and agricultural product consumers to serious health risks. Natural pesticides, often known as "reduced risk" pesticides, are organic chemicals that efficiently manage insect pests while posing little harm to no target species including people, animals, natural enemies, and the environment. Because most natural pesticides degrade rapidly in sunlight, they should be kept in the shade to maintain their efficacy.

About 80% of pesticides applied enters various environmental resources as a result of run-off, exposing animals, and farmers as well as consumers of the agricultural produce to severe health problem. Natural pesticides or "reduced risk" pesticides are natural compounds that effectively control insect pests, with low toxicity to no target organisms such as humans, animals and natural enemies and the environment. Most of natural pesticides break down very quickly in sunlight so they should be stored in darkness for effectiveness. Both highly alkaline and highly acid conditions speed up degradation or break down these type of pesticides[1]–[5].

Plants and some microorganism produce many natural chemicals that they use for their own defense against insects and disease organisms. Natural pesticides for plants also are considered to be those chemical made from natural ingredients. People believe that natural pesticides are always safe and more eco-friendly than man-made or synthetic pesticides and while this is mostly true but it is not always so for example, nicotine as a natural pesticide in tobacco leaves, and the highly addictive component of cigarette smoke, but it is much more toxic than most modern synthetic or manmade pesticides. While some natural pesticides are also toxic many are actually much safe and more eco-friendly than synthetic pesticides. Since natural pesticides are also very effective, it should be the first choice for most home and farm pest control needs.

Chemicals assault or enters the body at almost every hour of the day. They may come through air, food, products use on the body, and in drinking water. Toxic buildup of these chemicals has been shown to cause several damage in the body and minimize health. Many modern pesticides (synthetic) used persist in soil for years and compound the store of toxins such as heavy metals in the soil, air and water. Natural pesticides are not products of chemical engineering and are return to the environment with less impact and reduced danger[6]–[10].

Pesticides for organic gardens must meet certain criteria set forth by the United States Department of Agriculture (USDA) and bear a logo stating they are certified for use. The benefits of using organic or natural pesticides for plants are their specific target range, a slow mode of action, shorter persistence, low residue levels and safe use than conventional or synthetic pesticides [5]. These attributes are a win-win for consumers and the earth alike, but strict attention to time and mode of application and the precautions have to be strictly followed. That doesn't mean they are free from chemicals, just that the chemicals are derived from botanical and mineral sources. They must still be used carefully, but the chemicals break down more quickly than commercial sources and are deemed less threatening.

The recognized categories of bio-rational pesticides may be synthetic or natural compounds of microbial, plant protectant and biochemical (pheromones, hormones, natural growth regulators and enzymes) origins. Most bio pesticides are nerve poisons acting at specific target sites in the insect's nervous system. Some pesticides act similarly to the old nerve poisons that result in knock-down, rapid intoxication, lack of coordination, paralysis and death, and have higher affinity to insect receptors than to mammalian. The other pesticides affect specific systems, such as the molting processes, metamorphosis and the pest endocrinology system.

Bio pesticides are third-generation pesticides that are environmentally friendly and closely resemble or are identical to chemicals produced in nature. The examples of bio pesticides are the microbial pesticide *Bacillus thuringiensis* (Kurstaki), Most of the bio pesticides show effectiveness against different strains of resistant species, with no evidence of cross-resistance; hence these can play an important role in integrated resistance management (IRM) strategies.

1.1.Pesticides :

Pesticides are chemical substance use to kill or retard the growth of pests that damage or interfere with the growth of crops, shrubs, trees, timber and other vegetation desired by humans. Practically all chemical pesticides, however, are poisons and pose a long-term danger to the environment and humans through their persistence in nature or body tissue. Most of the pesticides are non-specific and may kill life forms that are harmless or useful. Pesticides are classified in three ways generally: Based on chemical structures, According to their mode of action and According to their mode of entry i.e. ingestion, inhalation, contact absorption.

1.2.Natural pesticides:

Natural pesticides are naturally occurring chemicals extracted from plants. Natural pesticide products are available as an alternative to synthetic chemical formulations but they are not necessarily less toxic to humans. Some deadly, fast-acting toxins and potent carcinogens occur naturally.

1.3.Pest management:

Pest management is a means of reducing pest numbers to an acceptable or economical threshold. While IPM is a developed method or ways use to control pests without relying solely on pesticides. The IPM is a systematic plan which brings together different pest control tactics into one program. Management does not mean eradicating pest. It means finding tactics that are effective and economical, and that keep environmental damage to a minimum level.

1.4.Mode of action:

The mode of action or mechanism of action of pesticide is how the pesticide works. In other words, it is how the specific systems in the pest are affected by the pesticide. Mode of action refers to the specific biochemical interaction through which a pesticide produces its effect on the pest. Usually, the mode of action includes the specific enzyme, protein, or biological step affected. While most other classifications are the pests controlled, physical characteristics, or chemical composition, mode of action specifically refers to which biological process the pesticide interrupts.

Knowing the mode of action is integral for scientists to improve the quality and sustainability of a product. To understand how pesticides work (their mode of action), it is necessary to understand how the pests' targeted systems normally function. It is also helpful to understand how human systems function in order to know similarities and differences between humans and the pests we try to control. It is also very important to understand the modes of action of the pesticides we use is to prevent the development of pesticide resistance in the target pest(s). Using pesticides with same mode of action contributes to this problem by killing the susceptible pests and leaving only those with resistance to the entire class of pesticides that work through similar mechanisms.

1.5. Uses of Bio Pesticides:

Bio pesticides give better control than conventional pesticides such as organochlorine, biopesticides are usually a narrow spectrum of activity; are cheaper, less toxic to workers or consumers; usually true to type, safer for the environment and for beneficial insects; and required for certified organic production surroundings. Bio pesticides may be applied shortly before harvest without leaving excessive residues, are less persistence in the environment and have reduced risks to non-target organisms.

They act very quickly in insect to stop feeding, they may not cause death for hours or days, but they often cause immediate paralysis or cessation of pests feeding. Most bio pesticides insecticides may have low to moderate mammalian toxicity. In the field, their rapid degradation and action as stomach poisons make them more selective in some instances for plant-feeding pest insects and less harmful to beneficial insects. Many bio pesticide are not toxic to plants, however, it is always best to test a new product on few plants first before applying on a large scale.

1.6. Various Types of Natural Pesticides:

The major categories of bio pesticides include botanicals, microbial, essential oil and minerals based, many of these come from plants themselves, insects, or naturally occurring minerals. Some of the more commonly used and effective natural pesticides are insect and mite growth regulators, *Bacillus thuringiensis* (Kurstaki), horticultural oils, insecticidal soaps, entomopathogenic nematodes and neem products. The advantage of using biological products is because they have less negative impact non-target organisms, including humans.

Nicotine is an alkaloid obtained from the foliage of tobacco plants (*Nicotinatabacum*) and related species, has a long history as an insecticide. Nicotine and two closely related alkaloids, nor nicotine and anabases, are synaptic poisons that mimic the neurotransmitter acetylcholine. As such, they cause symptoms of poisoning similar to those seen with organophosphate and carbamate insecticides.

Owing to the extreme toxicity of pure nicotine to mammals (rat oral LD50 is 50 mg kg⁻¹) and its rapid dermal absorption in humans, nicotine has seen declining use, primarily as a fumigant in greenhouses against soft-bodied pests. However, there remains some interest in preparing stable nicotine fatty acid soaps, presumably with reduced bioavailability and toxicity to humans. Nicotine is a Pale yellow to dark brown liquid which is highly toxic to warm-blooded animals. Nicotine is a fast-acting contact killer for soft bodies but does not kill most chewing insects. Nicotine is highly lipophilic and can pass through dermal tissues as well as the blood brain barrier.

1.7. Neem Products (Azadirachtin):

Neem is derived from the neem tree (*Azadiractaindica*) of arid tropical regions, contains several insecticidal compounds. Neem (*Azadiractaindica*) belonging to the Meliaceae family has emerged as a highly potent biopesticide. The main active ingredients is azadirachtin, which both deters and kills many species of caterpillars, thrips and whitefly. Both seeds and leaves can be used to prepare the neem solution. Neem seeds contain a higher amount of neem oil. The leaves of neem are available all year compared to the seed. A neem solution loses its effectiveness within about 8 hours after preparation, and when exposed to direct sunlight. It is most effective to apply neem in the evening, directly after preparation, under humid conditions or when the

plants and insects are damp. High neem concentration can cause burning of plant leaves. Also, natural enemies can be affected by neem applications.

1.8. General Mode of Action of Natural Pesticides:

Mode of action is the sum of anatomical, physiological and biochemical interactions and responses that result in the toxic action of a chemical, as well as the physical (location) and molecular (degradation) fate of the chemical in the organism. These compounds have achieved several currently desired goals of pest managers and the greater public demands. These are very selective, targeting just the pest, usually do not persist in the environment, much safer to handle and apply when compared to most chemical pesticides, and tend to preserve beneficial organisms. The most of the bio-rational insecticides have diverse modes of action, show effectiveness against different strains of resistant species, with no evidence of cross-resistance, has assisted in managing resistance to insect pests and they can play an important role in IRM strategies. Most bio-rational pesticides are nerve poisons acting at specific target sites in the insect's nervous system. Some insecticides act

similarly to the old nerve poisons that result from knocking-down, rapid intoxication, lack of coordination, paralysis and death, and have higher affinity to insect receptors than to mammalian. The other insecticides affect specific systems, such as the molting processes, metamorphosis and the insect endocrinology system. All the bio-rational or low-risk insecticides have relatively low detrimental effect on the environment and its inhabitants, and have little or no adverse consequence for non-target organisms, thus rendering them among important components in IPM program.

1.9. Pest Management:

Pest management is a way to keep pests below the levels where they can cause economic damage. Management does not mean eradicating pests. It means finding tactics that are effective and economical, and that keep environmental damage to a minimum. The IPM is the managing of crops using many tactics to keep pest levels below an economic threshold.

IPM has been developing as a way to control pests without relying solely on pesticide. Integrated pest management is a systematic plan which brings together different pest-control tactics into one program. It reduces the emphasis on pesticides by including cultural, biological, genetic, physical, regulatory, and mechanical controls. To carry out an IPM program, you need to scout and monitor your fields, recognize abnormal conditions and identify their causes, understand the different control methods available, and determine the economic costs and benefits. A good IPM program requires planning, monitoring and evaluation.

2. DISCUSSION

Pest management are very site-specific. Pest management is based on the identification of pests, accurate measurement of pest populations, assessment of damage levels, and knowledge of available pest management strategies or tactics that enable the specialist to make intelligent decisions about control. The IPM offers the possibility of improving the effectiveness of pest control programs while reducing some of the negative effects. Many successful IPM programs have reduced pesticide use and increased protection of the environment.

Plants producing the above-mentioned compounds are known by the farmer because most of the time they grow in the same general area. Eco-friendly safer for user/applicator, and very effective when used correctly. Often these plants also have other uses like household insect

repellents or are plants with medicinal applications. The rapid degradation of the active product may be convenient as it reduces the risk of residues on food. Some of these products may be used shortly before harvesting. Since most of these products have a stomach action and are rapidly decomposed they may be more selective to insect pests and less aggressive with natural enemies.

3. CONCLUSION

Soil pollution, Air pollution has occurred from the use of synthetic pesticides and it takes years and sometimes decades for some of these chemicals to break down. These pesticides are also harmful to the animal, microorganisms, plants as well as human health. Luckily there are many Natural pesticides (Bio pesticides) that are also effective in pest control. People need to break the habit of using harmful pesticides and switch to bio pesticides which break down quickly in sunlight and in the soil. The faster a chemical breaks down, the sooner the soil can return to a healthy state. Most bio 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.

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