



Biopesticides : A Natural Way of Pest Management.

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Abstract

The publication enlightens awareness of bio pesticides and biological pest management practice. This will surely help in the selectivity of beneficial animals. Many of the modern pesticides used today, persist in soil for years. The toxicity build-up of these chemicals has been shown to cause damage in animals, plants, human health and are not easily degradable in the environment. Studies have shown that some plants contain components that are toxic to insects and pest called bio pesticides. Natural pesticides are made by organisms usually for their own defence, or are derived from a natural source such as plant, animal, bacteria, and certain mineral. A few examples of these natural pesticides are Rotenone , carboxin, nicotine, neem etc

Natural pesticides usually target nervous system, resulting in knock-down, lack of coordination, paralysis and finally death of the organism. Rotenone inhibits the transfer of electron from NADH to ubiquinone. It disrupts energy metabolism by inhibiting the electron transport system (ETS). The latter block ATP synthesis in the mitochondria. Nicotine inhibits and competes with neurotransmitter acetylcholine receptors at the nerve synapses. Pyrethrum exerts their toxic effect by disrupting the sodium and potassium ion. This interrupts the normal transmission of nerve impulses. Most pesticides show their effect through contact, respiratory, or stomach poisons to the target organism. Bio pesticides are generally bio-degradable. And they are also very effective. Natural pesticides should be the first choice for pest management. This review explains the major natural pesticides, mechanism, mode of action and origin.

INTRODUCTION

Pest management is a way to keep pests below the levels where they can cause undesired damage. Management does not mean eradicating pest from the nature. It means finding the methods that are effective and economical. All this will keep environmental to a minimum damage. The IPM is the managing of crops using many ways to keep pest levels below an economic threshold. The IPM has been developing as a way to control pests without relying solely on pesticide. Integrated pest management is a systematic perfect natural plan which brings together different pest-control methods into one program. It reduces the emphasis on pesticides by including cultural, biological, genetic, physical, regulatory, and mechanical controls. A good IPM program requires planning, monitory and evaluation. 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 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. Successful IPM will increase protection of the environment.

Natural pesticides are chemicals made by other organisms usually for their own defence. They are derived from a natural source such as plant, animal, bacteria, and certain mineral. About 90% of Natural pesticides or “reduced risk” pesticides are natural compounds that effectively control insect pests, with low toxicity to nontarget organisms such as humans, animals and natural enemies and the environment. Most of natural pesticides degrade very quickly in sunlight. Hence, they should be stored in darkness for effectiveness

Pest: Pest is an organism who is harmful, destructive, or troublesome, to a plant or a microorganism.

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. Most of the pesticides are non-specific and may kill life forms that are harmless or useful in the nature.

Natural pesticides: Natural pesticides are naturally occurring chemicals extracted from the plants. Natural pesticides are available as an alternative to synthetic chemicals, which are deadly, fast-acting toxins and potent carcinogens.

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

SCOPE OF BIOPESTICIDES: Bio pesticides are a distinct group of pesticides which are different from conventional pesticides. They are comprised of two major categories, which are the biochemical pest control agents (e.g., pheromones, hormones, natural plant growth regulators and enzymes) and the microbial pest control agents (e.g., microorganisms). Pesticides included in these categories must be naturally occurring, or if man synthesizes the chemical, and then it must be structurally safe and identical to a naturally occurring chemical.. Thus, the application of active toxic bio pesticides agents as an alternative control strategy results in an urge to look for environment-friendly, biodegradable and easily available at affordable prices products for pests control.

Uses of Biopesticides: 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 biopesticide 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

LIST OF NATURAL PESTICIDES (BIOPESTICIDES)

Natural pesticides are naturally occurring chemicals extracted from plants 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. These natural pesticides include: Rotenone, Nicotine, Neem, Ryania, Pyrethrins, Sabadilla, Fluoroacetate, Carboxin and Bacillus thuringiensis

Oily Substance: Some plants also produce essential oils in specialized cells. Peppermint oil control household pests such as cockroaches and ants. Clove oil inhibits soil born fungal disease. Citrus oil control flea, aphid and mites. Lavender oil is insect repellent. In this way we can use essential oils as biocontrol agents.

Rotenone: Rotenone is an insecticide which have been in use for centuries. Products containing rotenone are typically prepared from plant species of the genus *Derris*. Although rotenone is the active ingredients of deguelin. Rotenone based products are approved for use as organic insecticides under many trade names and most are sold as blends containing both rotenone and pyrethrum extracts. Rotenone has been in use as a fish poison for more than 150 years. It is highly toxic to fish and is often used to eradicate unwanted fish.

Rotenone mode of action: Rotenone is an important insecticide extracted from various leguminous plants. It inhibits the transfer of electrons from nicotine amide-adenine (NADH) to ubiquinone. Rotenone is a powerful inhibitor of cellular respiration, the process that converts nutrient compounds into energy at the cellular level. In insects rotenone exerts its toxic effects primarily on nerve and muscle cells, causing rapid cessation of feeding.

Nicotine: Nicotine is an alkaloid obtained from the foliage of tobacco plants (*Nicotiana tabacum*) and related species. It has a long history as an insecticide in the society. 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. 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.

Nicotine mode of action: In both insects and mammals, nicotine is an extremely fast-acting nerve toxin. It competes with acetylcholine, the major neurotransmitter, by binding to acetylcholine receptors at nerve synapses and causing uncontrolled nerve firing. This disruption of normal nerve impulse activity results in rapid failure of those body systems that depend on nervous input for proper response.

Pyrethrum: Pyrethrum, also known as pyrethrums, is extracted from the seed of *Chrysanthemum cineraria folium*. The later has been used as an insecticide for over 100 years. Pyrethrum is effective against a wide range of soft-bodied pests such as scales, whitefly, bugs etc. Pyrethrins are neurotoxins that attack an insect's nervous system and cause repeated nerve firings. They may also have a repellent effect. Pyrethrins are easily broken down by stomach acids in mammals, so toxicity to humans and pets is very low. However, toxicity can occur when significantly more products is applied than specified. Pyrethrum is a broad-spectrum insecticide that is toxic to beneficial insects. Pyrethrum can paralyze insects upon exposure.

Pyrethrin mode of action: Pyrethrin cause immediate paralysis to most insects. Low doses do not kill but have a knockdown effect. Stronger does kill. Pyrethrin are not poisonous for humans and warm-blooded animals. However, human allergic reactions are common. It can cause rash, and breathing the dust can cause headaches and sickness. Pyrethrin exert their toxic effects by disrupting the sodium and potassium ion exchange process in insect nerve fibers. Pyrethrin insecticides are extremely fast-acting and cause an immediate paralysis in insects.

Neem Products (Azadirachtin) : Azadirachtin is derived from the neem tree (*Azadirachta indica*) of arid tropical regions. Neem (*Azadirachta indica*) belongs to the Meliaceae family. It has highly potent biopesticide property. The main active ingredients is azadirachtin. It kills many species of caterpillars, thrips and whitefly.. A neem solution loses its effectiveness within about 8 hours after preparation. 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.

Azadirachtin mode of action : Neem products are complex mixtures of biologically active materials. It is difficult to pinpoint the exact modes of action of various extracts. In insects, neem is most active as a feeding deterrent. It serves as a repellent, growth inhibitor, suppressant and toxic. As a repellent, neem prevents insects feeding.

Bacillus thuringiensis: This is most common microbial 'active ingredient'. Most of which are used to control caterpillar pests. Specific strains of B.T. have been selected for their ability to control mosquitos, black flies and other organisms. Bt. strains are used for controlling larvae of many Lepidoptera pests. While some crops have been modified to express the insecticidal protein produced by *B. thuringiensis*. The best of known is Bt cotton.

GENERAL MODE OF ACTION OF NATURAL PESTICIDE

It is the sum total of anatomical, physiological and biochemical interactions and responses that result in toxic action. These compounds have achieved several currently desired goals of pest management. The most of the bio insecticides have diverse modes of action. Most bio-rational pesticides are nerve poisons acting at specific target sites in the insect's nervous system. The most of the bio-rational insecticides show effectiveness against different strains of resistant species.

Opportunity of Bio pesticides: Efforts have been made to find bio-rational insecticides with novel modes of action and have no cross-resistance with the old insecticides. Bio pesticides are a distinct group, different from conventional pesticides. They are comprised of two major categories, the biochemical pest control agents (e.g., pheromones, hormones, natural plant growth regulators and enzymes) and the microbial pest control agents (e.g., microorganisms). Pesticides to be included in these categories must be naturally occurring. Minor differences between the stereo chemical isomer ratios are permitted. Thus, application of bio pesticides will be environment-friendly. We should try to make availability of bio pesticides at affordable prices for pest's control.

Advantages of Natural Pesticides

1. These can be obtained from the plants growing in the same general area.
2. Eco-friendly and safer for use.
3. These have medicinal applications.
4. Their rapid degradation of the active product may be convenient as it reduces the risk of residues on food.
5. Some of these products may be used shortly before harvesting.
6. Many of these products act very quickly inhibiting insect feeding.
7. Since most of these products have a stomach action and are rapidly decomposed.
8. Most of these compounds are not phytotoxic.
9. Resistance to these compounds is not developed.

Disadvantages of Natural Pesticides

1. Some of these products are not truly pesticides.
2. They are rapidly degraded by UV light hence their residual action is short.
3. Plant pesticides are less toxic to other animals than synthetic ones.
4. They are available seasonally.
5. Pest develop tolerance.

CONCLUSION

Use of synthetic pesticides cause soil pollution and air pollution. These pesticides are also harmful to the animal, microorganisms, plants as well as human health. By the grace of nature there are many Natural pesticides (Bio pesticides) that are effective in pest control. People are required to break the habit of using harmful pesticides. They have to switch for biopesticides. These are degraded quickly in sunlight and in the soil. As 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. Most bio pesticides are pest replant and be easily washed from fruits and vegetables making them healthier for us and our family to eat. The nature will be in safe hands if the farmers switch for bio pesticides.

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