Young Scientist- Tomorrow's Science Begins Today
Vol. 1, 2015
ISSN: 2581-4737

ROLE OF CERTAIN MICROBIAL BIOPESTICIDES IN FARMING

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ABSTRACT

Farming of all types such as Organic, Dryland, Agroforestry, or Commercial farming-each type faces the menace of pests. To curb this type of problem, besides harmful chemical pesticides, the pesticides of biological origin which have suitably been called biopesticides play an important role in farming. Biopesticides are pesticides derived from biological species or materials in nature such as animals, plants, bacteria, minerals etc. Besides traditional use of neem, turmeric etc. the bacterial, viral and fungal, protozoal, nematodial pesticides have also proven to be efficient biopesticides. Their use is considered significant for various reasons and these also make a part of Integrated Pest Management. The target specificity and biodegradability is observed. Certain Bacillus Species like *Bacillus thuringiensis* (Bt) *Agrobacterium radiobacter, B.popilliae*, Virus Species like *Helicide armigeraNuclear Polyhedrosis viruses* (NPVs*) Spodoptera litura* and Fungal species like *Trichoderma sps., Beauveria bassania* Zoophthora radicans and Protozoans like *Varimorpha, Malamoeba, Nosema* etc. have shown good results which further can be taken for more wider applicability of biopesticides in farming.

KEYWORDS: biopesticides, *Bacillus thuringiensis.* NPV, *Beauveria bassania*

INTRODUCTION

India is known for farming as major occupation of people. Different geographies of land project differences in types of farming practices such as organic farming in plains, dry land farming of dry and semi-arid regions, and agroforestry or commercial farming -but all practices face problems of pests. The traditional ways of keeping pests at bay through use of nature and its products have always been in practice. Advanced techniques have provided better solutions to manage pests by making microbes work as pesticides. Besides use of neem, turmeric or canola as direct controllers for pest management since early ages, some nematodes and other animals, bacterial species, viral species and fungal species, protozoan species of microbial world have proven results for effective pest management. Such naturally

ISSN: 2581-4737

derived managers are classified as biopesticides or biological pesticides. These pesticides of microbial origin find their way of being used in farming since beginning of twentieth century. The era of bacterial pesticide (Bt) had its beginning when, in 1901, a Japanese scientist named Shigetane Ishiwata isolated a bacterium from dead silkworm larvae while he was investigating the cause of the socalled "sotto disease" (sudden-collapse disease). The disease was responsible for the loss of large numbers of silkworms in Japan and the surrounding region. Ishiwata named the bacterium *Bacillus sotto*[1]. A few years thereafter, in 1911, a German scientist Ernst Berliner isolated a related strain from dead Mediterranean flour moth larvae he found in a flour mill in the German state of Thuringia. He appropriately named the organism *Bacillus thuringiensis*. Farmers started to use Bt as a pesticide in 1920. Bioinsecticide using *Bacillus thuringiensis*[2,3] had made commercial production as Sporeine (Bt product) in France way back in 1938. Americans had started biopesticidal use since 1950s and researches on Bt were on boom.

TYPES OF BIOPESTICIDES

Microbial pesticides- involvement of bacteria, virus or fungus or protozoan in pest control. Most prominent works on efficacy as biopesticide have been done using *Bacillus thuringiensis*.[5,6] Researches have been done on viral and fungal biopesticides. The commonly studied fungal biopesticides[7] who also make a part of Integrated Pest Management are Trichoderma species, *Beauveria bassiana*[7], *Cordyceps fumosorosa, Acanthomyces muscarius*. Pesticide of viral nature such as*Heliocoverpa zea Nuclear Polyhedrose Virus (NPV)*[4], *Helicide armigera, Spodoptera litura* have also shown efficacy of controlling pests .The ability to genetically improve the properties of such NPVs[9] as a pesticide provides the opportunity to develop a commercially viable product to control this pest species.[13] Protozoan biopesticides like *Varimorpha, Nosema* also kill insects.

Biochemical Pesticides-Pesticides in form of semiochemicals[11] such as insect sex pheromones which help in controlling reproduction rate of its own species or notify of dangers to its society and allelochemicals[11] used for communication between individuals belonging to different species, such as plants and insects or plants and other plants and scented or aromatic plant extracts that attract pests to trap them make this category act as biochemical pesticides.

Plant incorporated Protectants-Plants produce some such products that are amalgamated with genes of microbes such as Bt which can increase efficacy as synergistic effect to kill pests.[2] The genes for Bt pesticidal material is introduced to plant's own genetic material to produce substance that destroys the pest.[3] Pesticide product C5Honey sweet plum contains the plant incorporated protectant(PIP)active ingredient, coat protein gene of plum pox virus (CPG-PPV)[12]. This PIP is registered as a new food use and first outdoor use of pesticide. PPV is a plant virus that reduces the quality of stone fruitsand eventually renders infected trees incapable of producing fruit. This Plum Pox Virus (PPV) was first described in 1915 and is found in many developed countries as US, Canada, New York and such.

ISSN: 2581-4737

CHARACTERISTICS OF BIOPESTICIDES THAT FAVOUR FARMING

These are target specific and hence do not harm other non-target species like useful worms, insects, birds, mammals, other wildlife and other living organisms.

These are less toxic and hence do not disturb soil fertility. These decompose quickly and naturally.

These are required in low amounts. The chance of developing resistance amongst insects and pests is minimized. These do not pose threats of pollution to nature.

These can serve as alternative to chemical pesticides such as BHC, DDT etc. banned by Ministry of Agriculture and Farmers' Welfare.

RESULTS AND DISCUSSION

In 1950s Americans were using biopesticides and various researches on Bt were done. But the outbreak of malaria paved way for import and later production and wide use of Dichloro Diphenyl Trichloroethane (DDT) which was developed and widely used as pesticide in farming before getting banned in 1989. For replacement to synthetic pesticides biopesticides such as DDT, BHC, the softer version of pesticides - the microbial origin of biopesticides was a choice of research and practice. Works on Neem, Pyrethrum, nematodes and microbial pesticides from Bacillus NPV, Trichoderma became major biopesticides to be produced and used in India.Bacterial biopesticides produce toxins[8] that are harmful when ingested by certain pests; fungal biopesticides control insects through growth and secretion of enzymes that weaken the outer coat of the insects. Protozoan biopesticides like Varimorpha, Malamoeba, Nosema sps. Generally killinsects as these pesticides change behavior of insects which leads to starvation and finally death of pest. Bt is safe for humans and is most widely used environmentally compatible biopesticide worldwide. Furthermore, insecticidal Bt genes have been incorporated into several major crops, rendering them insect resistant, and thus providing a model for genetic engineering in agriculture[2,3]. The ability to genetically improve the properties of NPV as a pesticide provides the opportunity to develop a commercially viable product to control pest species. The sustainable farming system needs shedding of hard chemical pesticides and should move to softer option of IPM combined with cultural and biological control measures. The biopesticidal global market share needs upheavel by increasing supply of such products which can meet the demands, of farming, and making these biopesticides within reach of farmers with low cost.

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