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ESA Position Statement on Microbial Insecticides

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The Entomological Society of America (ESA) endorses the discovery, development, and use of microbial insecticides as insect pest management tools and as chemical pesticide alternatives where feasible.

Definition

Microbial insecticides are naturally occurring and genetically modified insect pathogens that directly or indirectly reduce insect pest populations. They include bacteria, viruses, protozoa, fungi, nematodes, and other organisms that infect and exterminate insects. A growing number of these insecticides exist in the United States as successful pest management tools. The bacterium Bacillus thuringiensis is perhaps the best-known example.

Benefits of Microbial Insecticides

Environmental safety

The main rationale for the development of microbial insecticides is environmental safety. Some pathogens selected for commercial development, such as viruses and bacteria, may infect only a single or small number of closely related insect pest species. Others, such as fungi and nematodes, may affect a fairly wide range of insects and related arthropod pests. However, none of these commercially available microbial pathogens have been shown to infect vertebrates or plants.

Non-disruptive, environmental compatibility

Predatory and parasitic insects normally feed on pest insect populations. Unlike many broad-spectrum synthetic pesticides, insect pathogens kill few if any beneficial organisms, thus complementing rather than replacing this source of natural control. Their use does not contaminate ground and surface water supplies or cause other environmental problems commonly associated with broad-spectrum chemical pesticides.

Registration

The U.S. Environmental Protection Agency (EPA) has developed rigorous, worst-case scenario protocols for testing the safety of microbial pesticides. These tests are fast, definitive, and relatively inexpensive, compared to those required for synthetic chemical pesticide registration.

Public acceptance

Once adequate education on their safety and selectivity has been provided, use of most microbial insecticides has been readily accepted by users.

Special-use groups
A growing segment of consumers is supportive of naturally based pest management programs that result in organically or more naturally produced foods and fibers. These consumers view microbial insecticides as preferable alternatives to synthetic chemical pesticides.

Self-replicating
Many insect pathogens reproduce in their hosts and remain in the hosts' environment to infect subsequent generations. This is especially effective and useful for pest pathogens that have been introduced into new habitats and do not have natural means to control these non-native insects.

Effective in pre-stressed hosts
Pathogens often are effective when applied to host insects already stressed by other chronic or low-grade infections. Such conditions are frequently encountered in pest populations.

Use in sensitive habitats
Microbial pesticides can be used in many habitats where chemical pesticides have been prohibited. Such habitats include recreational and urban areas, lake and stream borders of watersheds, and near homes and schools in agricultural settings.

Use where pre-harvest intervals prevent chemical applications
Most chemical pesticides cannot be used on crops for certain time periods (days to weeks) prior to harvest, because their residues will not have time to dissipate before the product is processed or consumed. Microbial pesticides do not produce residues of health concern and can be used to protect commodities at any time.

Field re-entry intervals
Workers who need to re-enter crop fields for harvesting or other activities have to wait hours or days after the application of many chemical pesticides. With microbial insecticides, they have reduced or no wait time.

Chemical compatibility
Microbial pesticides can be used with some chemical pesticides, particularly newer, environmentally friendly chemicals. Combining both chemical and microbial pesticides -- to reduce the amounts of needed chemical pesticides -- reduces negative environmental impacts that older classes of chemical insecticides can cause.

Ease of application
Microbial insecticides generally can be applied with standard spray equipment and do not require the purchase of highly specialized and dedicated sprayers.

Genetically modifiable

Many insect pathogens can be modified through classical genetic or molecular manipulation in a variety of ways to produce microbes with improved insecticidal properties.

Problems Associated with the Use of Microbial Insecticides

Limited market potential
Large agribusinesses produce chemical pesticides that generally have the ability to capture large percentages of the global pesticide market. Microbial insecticides tend to affect more specific types of insects than chemical pesticides. Therefore, microbial insecticides have less global marketing potential. Many of them are characterized as suitable for niche markets with limited sales potential. Small companies could produce and market such products profitably, but they often lack the resources to risk investing in their development.

Multiple pest complexes
A microbial pathogen that reduces its host population well but spares other pests may not be acceptable to pest managers dealing with crops under simultaneous attacks by multiple pest species.

Delayed extermination
Many microbial insecticides do not exterminate insect pests rapidly, so these insects continue to feed, and thereby damage crops, for several days between infection and death.

Resistance
Some insects develop resistance to several insect pathogens. If pathogens are to be used successfully and continuously, resistance management will have to be practiced, as it is with chemical pesticides.

Higher knowledge required for user
Biologically based pest management systems, such as microbial insecticides, often require more in-depth knowledge of the interactions among pest, host, and environment. Biological agents inherently are more complex than chemical pesticides and have more complex interactions with environmental components.

Limited product stability
Because many microbial insecticides have short shelf lives, new formulations, packaging, marketing strategies, and quality controls have been developed to ensure product viability and activity. Ultraviolet (UV) light degrades most microbial insecticides, so they must be protected from UV light when applied in the field.

Recommendations

Funding
It is imperative that scientists receive continued funding to discover, characterize, develop, and in some cases, register microbial insecticides. Such support will promote

identification of promising candidate microbial insecticides that can be developed and used by small and large agribusiness industries.

Research

More research is needed to better understand the interactions of microbial insecticides with pest species, natural enemies, and other components of the ecosystems in which they are used to ensure that these products are used to their full potential and can provide the greatest benefits to farmers, foresters, public health officers, homeowners, and other users.

Also, while microbial insecticides are highly specific, there can be cases in which their host range can include endangered, threatened, or rare insects. Environmental impact studies should be conducted where such insecticide use might affect such species.

Regulatory policies

Insect pathogens imported from one country to another have provided many excellent pest management tools and successes. U.S. regulatory policies on these imports should not become so restrictive that they discourage scientists from seeking valuable new pathogens or strains from international sources.

EPA has encouraged the development of microbial insecticides through a “fast track” registration policy. This has involved a priority examination of submissions of required registration materials. U.S. regulatory agencies involved in the movement of microbial insecticides should develop guidelines to help this process become as streamlined as possible.

Non-native pathogens already present in the United States that EPA has deemed safe for environmental release should be characterized and approved for development without additional restrictions. This would encourage the development and deployment of microbial insecticides that have demonstrated environmentally safe track records.

The Entomological Society of America is the largest organization in the world serving the professional and scientific needs of entomologists and people in related disciplines. Founded in 1889, ESA today has more than 7,000 members worldwide affiliated with educational institutions, health agencies, private industry, and government. Members, many of whom utilize collections directly or indirectly but all of whom understand their importance, include researchers, teachers, extension educators, administrators, marketing representatives, research technicians, consultants, students, and hobbyists. For more information, visit http://www.entsoc.org.